THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. SEPTEMBER 23, 1897. CHICAGO, ILL. NUMBER 38.

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The Iron Trade Review

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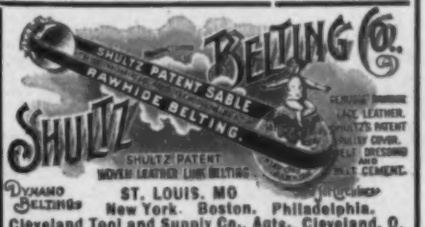
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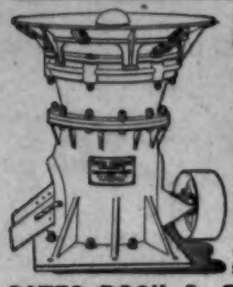

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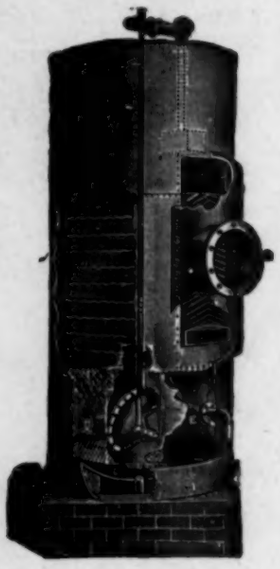

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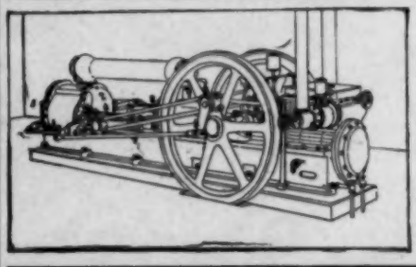

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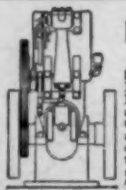

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THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. SEPTEMBER 23, 1897. CHICAGO, ILL. NUMBER 38

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Still exhibiting characteristics of genuineness and promises of permanence, the improvement in the iron trade has made further progress in the past week. The slowness of advances in some lines and in some sections, keeps the movement free from unhealthiness and adds to the stock of confidence. The features of the week are further advances in pig iron of all descriptions, in steel billets, in muck bar and iron skelp; in finished material, additional firmness in bars, but generally unchanged conditions as to all other rolled products, though wire nails are higher, with signs of continued strength. The buying of Bessemer pig iron in the Pittsburg and other Central Western districts has kept up, the total of the past two weeks being estimated at close to 100,000 tons. Further purchases are pending, since it is well known that large steel companies are consuming considerably more pig iron than they produce. While $9.85 in the valleys was the highest transaction reported last week, $10 has been done since, this being for 1898 delivery, and $10.25 is now minimum with most sellers. Gray forge has gone to $9.25 in the valley, and $9.50 to $9.75, Pittsburg, is quoted, this representing an advance of about $1.50 from the lowest point. Northern sellers of foundry iron have stiffened their prices in sympathy with the advances in other grades, and Southern sellers, finding order books well filled for four months ahead and orders steadily coming in, have held firmly to the advances noted last week. The Tennessee company, it is intimated, will make a further advance of 25 cents this week from the Birmingham basis of $7.25 for No. 2 foundry and No. 2 soft, $7.75 for No. 1 foundry and No. 1 soft, and $6.75 for gray forge. It is evident that Southern iron is now very close to the point at which exports will be prohibited. This would have been the case now, but for the recent advance in pig iron in England. The foundry buying of the past week has been of good volume. Some buyers hesitate in the face of the higher prices asked for deliveries in 1898, and sellers are likewise chary of business for next year. It is urged by Southern producers that the conditions affecting the supply of labor, and consequently of raw materials, are such to-day that there cannot be for some months any considerable addition to producing capacitythere. In the North the principal increase in production is in the Mahoning and Shenango valleys, where five furnaces have been put in blast since Sept. 1, and two others will be put in before Oct. 1. Pittsburg has added one in September, Western New York will have another active stack before Oct. 1, and Eastern and Central Pennsylvania will have two or three September additions. As in other revivals, the East is slow to catch the pace, and thus far the feeling there is considerably less buoyant than in the West, though Eastern pig iron and steel are higher and in finished material prices are quite well held. There is evidence of more business for car and locomotive works and the scarcity of cars to move grain to upper lake ports gives promise of additional rolling stock orders. Where business in rails has been done, it has been at an advance of about $1 a ton. Plate mills are fairly filled, but prices on considerable orders have been at a stand for several weeks. Structural material has sold at 1.05c, Pittsburg, for shapes, in small lots, but 1c is still possible on larger contracts. The well sold—if not in some cases oversold—condition of steel plants has been emphasized anew in the week. There are already complaints of slow deliveries. Billets have sold at $16 Pittsburg, maker's mill, and for prompt delivery are scarce. Wire rods are firm at $22 to $22.50, a sale at $22.35 Pittsburg being reported. Wire nails are $1.50 at Central Western mills.

THE CLEVELAND DISTRICT.

Among authorities in local ore circles, not given to speaking on mere hearsay, the entrance of the Carnegie-Oliver interest upon the Gogebic range is now treated as an accomplished fact. What remains unconsummated, it would appear, will determine the extent of the Oliver Mining Co.'s operations on that range; but so far as the Tilden property is concerned, it is believed that the deal is finished. With a considerable tonnage of desirable Gogebic ore taken out of the market, as will be the case when the present deal is completed, the average buyer of ore will find his choice of Bessemers moderately low in phosphorus more restricted than in years. Bessemer hematites on the old ranges have been drawn upon heavily in the past half dozen years and their scarcity may be accented in the seasons just ahead. It would seem, in this event, that prices must at least be on such a level as to permit the working of smaller Gogebic properties that were barred out by the schedule of 1897. In the past week there has been a further demand for both Bessemer and non-Bessemer ores and to-day the most desirable in both classes are taken up. Dock stocks, barring a large tonnage of Mesabi non-Bessemer, have been considerably reduced since May, indications now pointing to a larger year's sales of Lake Superior ores than in any year of the business. Current sales of ore are promptly covered by vessel charters and some negotiations for Marquette boats are now pending at 70 cents through October. The Duluth wild rate has been nominally 65 cents for several days, but nothing can be done below 70 cents, the beginning of the coal movement encouraging vessel men to hold aloof.

Pig Iron

The activity in Bessemer pig iron which was so pronounced last week has continued, though with a lessened volume of buying. A sale of 3,00 tons at $10, valley, deliveries in the first quarter of 1898, was made in the latter part of last week and $9.85 and $9.90, valley furnace, have been done for 1897 delivery. Furnaces are not disposed to quote at this juncture for 1898 delivery, in view of the uncertainty as to coke prices, and the indications that a considerable tonnage of Bessemer is yet to be taken for consumption by steel works whose blast furnaces are inadequate to their present and prospective output of steel. Tentative offers of $10.25, valley, for the first quarter of 1898, are reported as having been refused by several sellers, and predictions of $11 iron by the end of the year are as freely made as were $10 predictions one month ago. Rosena furnace, this week, and Alice and Soho furnaces, last week, have been added to the active list. These with Struthers, Spearman and Claire have been blown in since Sept. 1, and Hannah and Thomas will be added in a few days. Forge iron is more and more difficult to get, and while sales at $9 and $9.10 valley were made a few days ago, an offer of $9.35 at Shenango valley furnace was refused for one lot this week. The foundry

Continued on page 7

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1142 MONADNOCK BLOCK, Sept. 22.

General market conditions are even firmer than they were a week ago, and prices on a number of products have been advanced. Sales were not quite as large as were those of the week previous, as buyers have about filled their requirements for most materials and the mills and furnaces are so well filled with orders that they are not pushing for business, but are satisfied with what comes up naturally. In fact, some of the mills and furnaces are refusing orders, having sold their product for the balance of this year, and in some cases for the first month of next year.

PIG IRON.—Most of the large buyers who were in the market have satisfied their needs for the present, and the action of the furnaces in advancing prices has had the effect of restricting buying that was in any way speculative. Most of the buyers who are still in the market want only small lots. The smaller foundries seem to have difficulty in believing that advances in iron have actually been made, or if they have that there is sufficient warrant for the advances to make them permanent. As a rule, however, founders are satisfied to pay higher prices, providing their competitors pay as much. Quotations of last week remain unchanged, but there are rumors that the largest Southern producer is intending to make a further advance of 25 cents. The largest sale of the week in Southern iron was one of 1,500 tons. Most of the business placed both with Southern and Northern furnaces, was in small lots of 500 tons down. Quotations are unchanged:

Lake Sup. Charcoal	$13 00@13 25	South'n Coke No. 3	$10 25@10 50
Local Coke Fdy. No. 1	11 00@11 50	Southern No. 1 Soft	11 00@11 25
Local Coke Fdy. No. 2	10 50@11 00	Southern No. 2 Soft	10 50@10 75
Local Coke Fdy. No. 3	10 25@10 50	South'n Silveries	10 60@10 75
Local Scotch Fdy. No. 1	11 50@12 00	Jackson Co. Silveries	12 50@14 50
Local Scotch Fdy. No. 2	11 00@11 50	Ohio Strong Softeners	12 00@12 25
Local Scotch Fdy. No. 3	10 50@11 00	Alabama Car Wheel	15 50@16 00
South'n Coke No. 1	11 00@11 25	Malleable Bessemer	10 75@11 00
South'n Coke No. 2	10 50@10 75	Coke Bessemer	11 50@12 00

BARS.—Sales last week included several large contracts, and further good contracts are under negotiation. Small orders were frequent, and aggregated a good tonnage. The mills are becoming firmer in their views every day, and prices have an upward tendency. Quotations range from 1.10c to 1.20c for common iron, 1.20c to 1.30c for guaranteed iron, and 1.15c to 1.25c for soft steel bars from strictly billet stock. The local mills are well filled with orders for the balance of the year.

RAILS AND TRACK SUPPLIES.—Orders for about 6,000 tons of rails were placed last week, for delivery in December and January. The mills are filled with orders for the balance of this year, and are not accepting much business, except in small lots. The 6,000 tons mentioned above were taken at $20, Chicago. The market is very firm and quotations are unchanged as follows: Rails, $19 to $21, according to specifications; steel splice bars, 1.20c to 1.30c; track bolts, with square nuts, 1.80c to 1.90c; hexagon nuts, 1.90c to 2c; spikes, 1.55c to 1.60c.

BILLETS AND RODS.—The Illinois Steel Co.'s mills are filled for the balance of this year on both billets and rods, and are taking only orders for small quantities. Quotations are now made at $17.50 to $18 for billets, and $25 for rods.

STRUCTURAL MATERIAL.—The general run of orders in small lots was very good last week, and made a large aggregate. Only one large contract was taken, for 2,000 tons, the steel to be made in Pittsburg. This was for structural steel. Bridge builders continue to receive good orders from the railroads, and have a good business of this class in prospect. An inquiry was received last week for 4,000 tons of bridge material from a local bridge builder. Prices are very firm, and have been advanced in the week. Quotations are now made as follows: Beams and channels, 1.20c to 1.25c; angles, 1.20c to 1.25c; plates, 1.20c to 1.25c; tees, 1.30c to 1.40c. Small lots from stock are quoted one-quarter to one-half cent higher.

PLATES.—Business is excellent, and included in last week's sales were several large contracts. The outlook for the future is good, and sales are expected to keep up well for some time. Some mills are so well filled with orders that they have withdrawn from the market except on very desirable business. Quotations have been advanced, and are now made as follows: Tank steel, 1.20c to 1.25c; flange steel, 1.30c to 1.40c; fire-box steel, 1.85c to 5c.

SHEETS.—Orders are very satisfactory, and business from both mill and store was quite large. Further orders of large size are expected to be placed this week. Prices are very firm. Quotations are made at 2c to 2.05c for No. 27 black, and 80 and 5 to 80 and 2½ per cent discount for galvanized.

MERCHANT STEEL.—Local dealers report a good week's business, with an excellent demand still unfilled. Sales showed an increase last week and are expected to keep up for some time. Quotations are very firm, and are made as follows: Open-hearth spring, tire and machinery steel, 1.60c to 1.70c; smooth finished machinery steel, 1.50c to 1 55c; smooth finished tire, 1.35c to 1.40c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

SCRAP.—There is a good demand from the mills for rolling scrap, but the holders do not seem anxious to sell at the present prices. Business is quite a little better than in the preceding weeks, and is expected to improve from now on. Prices are much higher, and some dealers are asking even more than we quote on some kinds of scrap. Dealers' asking prices for old material are as follows:

Old iron rails, gross	$12 50@$13 00	Axles, net	$14 00@$14 25
Old steel rails, long, gr.	9 50@ 10 00	Cast borings, net	3 35@ 2 75
Old steel rails, short	8 00@ 8 50	Wrought turnings, net	4 50@ 5 00
Old wheels, gross	11 00@ 11 25	Axle turnings, net	6 00@ 6 50
Railroad forge, net	11 75@ 12 25	Mixed steel, gross	7 00
Dealer's forge, net	10 00@ 10 50	Stove plates, net	6 00@ 6 25
No. 1 mill, net	8 00@ 8 50	Heavy melting steel gr.	8 00@ 8 25
Heavy cast, net	7 75@ 8 25	Old iron splice b., gr.	11 75@ 12 00
Malleab.e cast, net	9 00@ 9 25		

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
807 TRADESMEN'S BUILDING, Sept. 22.

So far there is but little suspicion of inflated prices. Bessemer has not only maintained last week's advance but is reported scarce for prompt shipments at the new prices. Steel is strong at $16, maker's mill, with an increasing scarcity that promises still higher prices. In finished material the leading local interests are booked for weeks ahead on plates and bars, while in other lines there is much complaint over crowded mills and delayed shipments.

PIG IRON.—Sales of Bessemer pig iron have continued without interruption and in most instances price has been little questioned. Under previous options some iron has been secured at somewhat lower prices, notably a lot of 5,000 tons for delivery into January which sold at $9.75 valley. But transactions are since reported at $9.85 and $9.90 valley for this year's iron. A scarcity of spot iron is a feature of the present week and prices are strong at $9.90, valley furnace. For next year quotations are scarce owing to uncertainties of coke prices, but $10.25 has been offered on first quarter delivery and refused. One or two sales were made last week for first quarter delivery at $10 valley furnace. Gray forge cannot be had at the furnaces, but from second hands sold during the week at $9 and $9.10, valley—2,500 tons at $9 and 3,000 tons at $9.10. Foundry grades are erratic, some brands easily securing advances and others unchanged. Quotations made are as follows:

Bessemer at valley furnace last quarter	$ 9.85 to $10.00
Bessemer delivered Pittsburg District	10.50 to 10.75
No. 1 Foundry	10.35 to 10.50
No. 2 Foundry	9.75 to 10.00
No. 3 Foundry	9.35 to 9.50
Gray Forge, Valley	9.00 to 9.25
" " Pittsburg	9.50 to 9.75

BILLETS.—Billets are strong at $16, maker's mill. At, and slightly below, this figure 18,000 tons sold late in the week, one lot of 6,000 tons netting $16. Little steel is in sight and the scarcity is becoming more apparent in prices. Complaint is general regarding slow deliveries.

MUCK BAR.—Sales of muck bar are reported at $18.50 and $18.75 and $19.00 is asked. The scarcity causing higher prices is undiminished.

IRON AND STEEL SKELP.—Iron skelp, especially for prompt use, is hard to get and as a result is higher. Quotations are made as follows: Grooved iron skelp, 1.10c to 1.15c; sheared, 1.25c to 1.30c; grooved steel skelp, 97½c to 1c; sheared, 1.07½c to 1.10c.

PLATES.—All the local plate mills are well sold ahead and the largest one has sold its capacity six weeks ahead. All are slow in promising any extended deliveries at to-day's prices. On Bessemer and open-hearth tank 1.05c is held and sales are reported at this price. Shell is quoted at 1.10c to 1 15c and flange at 1.15c to 1.20c.

RAILROAD AND TRACK MATERIAL.—There is talk of further rail business, but few new orders have been booked as yet. Some export business in rails is being figured on. Rails are

quoted at $18 and $19, varying with the section. On track material we quote: Iron track bolts, 1.60c to 1.65c; steel spikes, 1.45c to 1.55c; splice bars, 1.10c to 1.15c; links and pins, 1.15c to 1.20c.

SHEETS.—Sheet mills are heavily booked and complaints are made regarding tardy shipments. Light sheet mills are especially full and corrugating interests report much trouble in getting material when promised. A slight advance is secured on light gauges owing to their scarcity and sales of No. 28 are reported at 2.05c and 2.10c. No. 26 is held at 1.90c and No. 27 at 1.95c. Galvanized are strong at 80 and 5 per cent off list. Zug & Co., Ltd., will hereafter roll black plates for tinning and the equipment is now being installed.

STRUCTURAL MATERIAL.—The new Bellfield Hotel will be let on Thursday of this week and as stockholders in both of the local interests are likewise stockholders in the new enterprise, price will probably determine the steel used. About 1,400 tons is needed. Beams and channels vary in price from 1c to 1.10c, as mills are not yet filled. On universal plates and angles, 1.05c is asked; on tees and zees, 1.15c to 1.25c.

FERRO-MANGANESE.—Domestic ferro-manganese, 80 per cent, is quoted at $46.

PIPES AND TUBES.—Advances in wages, the return of winter freights and higher skelp have led to talk of another advance in pipe, but as yet the movement has not taken form. Pipe mills are very full and find difficulty in supplying demand. Discounts are firm as quoted. Butt weld, galvanized, 50 per cent off; lap weld, galvanized, 55 per cent off; butt weld, black, 57 per cent off; lap weld, black, 67 per cent off. Steel pipe, 6 tens additional; iron, 5 tens and 5 per cent—both quotations being for carload lots. Discounts on boiler tubes are quoted as agreed: Two and a half inch, 77½ per cent off; two and two and one-quarter inch, 75 per cent off: one and one-third inch, 70 per cent off: and one three-quarters inch, 65 per cent off.

BARS.—Jones & Laughlins are booked ahead for nearly two months on steel bars. Orders of agricultural interests on contracts are coming in and bar mills generally are behind in deliveries. Those well filled are asking 1.05c as a minimum, but 1c can still be done. Valley iron mills are also filled and Pittsburg interests in better shape than for months. On common iron 1c to 1.05c valley and Pittsburg is asked. Branded bars are more active in response to railroad buying.

OLD MATERIAL.—Good wrought scrap and old iron rails are the selling lines in scrap. Of each a considerable tonnage has been bought—the rails being for valley delivery. A 5,000-ton lot of old iron rails sold at $13.50 valley and a smaller lot—reported to be 400 tons—brought $13.75 valley. The sales of wrought scrap—strictly No. 1—ranged from $11.25 to $11.50, net. A lot of 1,000 tons brought $11.65, gross.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Philadelphia The announcements of steady advances in Western markets, particularly in Bessemer pig iron and steel billets and in forge iron, muck bar and skelp iron, have had no corresponding effect in the East. There is a response in larger confidence and in an increased number of prophets of higher prices, but the actual gain in prices is very moderate. There is no disputing the improvement, but the capacity to turn out finished product is emphasized in local comment on the market, and the fact that related lines—the heavy foundries and other concerns that have to do with new industrial developments—are not showing signs of special quickening. The disposition here is general to make haste slowly and to follow the market rather than to attempt to accelerate the pace by buying to cover against a further upward tendency. If the advances in Western markets extend to finished material and lead mills in other districts to ask higher prices on Eastern deliveries the effect would be quickly evident here. As it is, a heavy business has been done in pig iron in the week, much of the iron selling on the basis of $10.75 and a shade less, for No. 2X, and $10.50 for No. 2 plain. These are figures that have been quoted for some weeks past, without being established by actual transactions. The buying of the week has covered the wants of many consumers for the balance of the year and on neither side of the market is there a disposition to do business far into 1898. The following quotations are now quite generally adhered to: No. 1X foundry, $11.75 to $12.25; No. 2X, $11 to $11.50; No. 2 plain, $10.50 to $10.75; standard mill iron, $10.50; ordinary mill iron, $10 to $10.25; basic iron, $10.50 to $10.75; Bessemer, $12 to $12.25. The billet market is stronger; not much buying, but at $17.75 to $18 the Pittsburg advance is scarcely represented here as yet. Buyers are not committing themselves on steel for the new year and will await further developments. In finished products, bars are about $1 a ton higher, refined iron being quoted 1.10c to 1.15c and steel 1.15c to 1.20c, while special iron bars are held at 1.25c to 1.30c. Plates and shapes are unchanged and there is no large new demand. On plates and angles 1.20c to 1.25c is the recognized range. Mills are all running full or nearly so, but there is no scarcity of material yet and this condition leads buyers to think some time before paying advances, though it is generally conceded that the indications point to a higher market.

Cincinnati. The well sold condition of all Southern furnaces gives greater firmness to the market than has been seen at any time since the improvement set in. A feature of the situation that has an important bearing on the immediate future is that, owing to the scarcity of labor in the Alabama district, it is not probable that any additions will be made soon to the list of active furnaces. Some producers there are now using up all the raw materials they are able to get out with present forces at mines and coke ovens, and until cold weather sets in it is not expected that these classes of laborers will be very much more plentiful. Inquiries in the past week have included a number from users of Northern irons who want Southern soft and silvery grades. Sales have been of good volume. The Tennessee company has put in the Little Belle Furnace at Bessemer, with an output of about 600 tons a week. In Northern brands there is a strong feeling and a fair movement. Bessemer and gray forge have had an advance and the great scarcity of the latter promises still higher prices. A Central Ohio pipe concern took 3,000 tons of Nos. 3 and 4 foundry in the week. Local houses have made large sales to foundries at Detroit, principally stove works, the total being about 20,000 tons. We quote as follows, with the prospect that an advance of 25 cents will be made this week by the leading Southern company: Southern coke, No. 1 foundry, $10; No. 2, $9.50; No. 3, $9.25; gray forge, $9; mottled, $9; No. 1 soft, $10; No. 2, $9.50; Hanging Rock charcoal, No. 1, $14.50 to $15.50; Tennessee charcoal, No. 1, $12.50 to $13; Jackson Co. silvery, No. 1, $12.50 to $13; standard Georgia car wheel, $14.25 to $15.

Experiments in Boiler Bracing.

The above was the title of a paper by Mr. Francis J. Cole, read at a recent meeting of the American Society of Mechanical Engineers, in which the author showed that the average holding power of stay bolts, when screwed through three-eighths plate and riveted over, when cold, is 16,350 lbs. for the worst, and 24,000 lbs. for the best; and when hot, 3,470 lbs. for worst, and 4,613 lbs. for the best. This would indicate that the best riveted head which can be formed cold, made in the usual conical shape, has a holding power, hot and cold, very much less than the worst form of bolt and solid head, even when nicked or grooved deeply under the head, or bolt screwed through with a nut on under side of sheet. It does not appear that the solid bottom head bolts are deficient in holding power when tested in this manner, but the principal objection to their use is the liability of injury when screwed into a fire-box where the holes are not tapped at right angles to the sheet, and where the surface of the sheet is curved.

MARIS BROTHERS, manufacturers of traveling cranes, of Philadelphia, are erecting a new machine shop. It will be 55 x 75 feet. Running the full length of the building will be a 10-ton power crane having a span of 30 feet. One side of the building will be arranged with a gallery on which will be placed the lighter machinery. The framework of the building is of steel, and the covering of the sides and roof will be corrugated iron. The Berlin Iron Bridge Co., of East Berlin, Conn., designed the structure and will furnish and erect all the material.

IT is reported that the Pennsylvania Steel Co. will establish an agency in London with a view to taking foreign business direct.

THE IRON TRADE REVIEW

DEVOTED TO IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES.

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THE COURSE OF PRICES.

As prices in iron and steel have gone steadily downward in the past 15 years, viewed apart from the special influences that have given alternate depression and boom, it has become more and more evident that the days of large profits and of violent fluctuations have gone never to return. The experiences of the past few years, in particular, with their unheard-of low prices for Lake Superior ores, their larger furnace outputs and their new economies in all furnace and steel works operations, have brought home with new force to all engaged in iron and steel manufacture the fact that in general the business will be dominated for years to come by forces that will keep the market close to the ground. But with each revival, after depression from special causes, the question is most searchingly canvassed as to what possibilities of expansion are contained in the influences that for the time being are dominant. Probably at no time has the question been more difficult of determination than just now. We have already canvassed in these columns the considerations that suggest increasing costs for the year that is ahead. But it has been demonstrated heretofore that when demand is less than supply, the cost of product does not fix, though it may modify, the market price of material. Much less, when demand is in advance of supply, does cost become a factor in fixing prices. But the usual experience in time of advancing prices is that cost increases more rapidly than profits. In 1895, for example, the furnaces in the valleys were compelled to grant two advances in wages before many of them had reaped any benefit whatever from the advances in pig iron. Contracts taken at the lower prices of the early months of the year lasted long after wages and coke had gone up. Thus the tendency is for sellers to hold firmly for successive advances, after the upward movement starts, because it is incumbent on them, not only to get a share of the going prosperity, in enlarged profits, but also to recoup for additions which the general revival has made to the cost of material that was sold at little or no margin in the beginning.

Referring specifically to the present situation: Thus far no additional labor cost has entered into the account. The movement is too young and the advances quite too modest to do more than carry producers across the line on to the side of profit. It is to be considered, moreover, that the business closed in the past four weeks—which cover substantially the period of perceptible improvement—will form a very small fraction of the output of furnaces and mills in the remainder of 1897. Most of them will wait until 1898, and many until some distance into the year, before the balance sheet will show any return from what now promises to be a gradually expanding movement, characterized by steady operation of plants and a satisfactory margin over cost.

THE inflation of prices that came in the boom of 1879–80, when bar iron went from $40 to $89 a ton at Philadelphia, from February to February; Hanging Rock car-wheel iron at Cincinnati, from $28 to $63 in the same period; No. 1 anthracite foundry pig from $18, Philadelphia, to $43; and steel rails from $45, Pennsylvania mill, to $85—such a rise is only recalled at times like the present to arouse memories of the flighty, feverish influences that have long since departed. And though 1895 is but two years back, its soaring prices are quoted now only as a suggestion of the revolutionary conditions that environ this movement of 1897, the outcome of which is now so anxiously questioned by the entire iron trade: From $9.50 at the lowest point in early 1895, local No. 2 foundry iron at Chicago went to $14.50 at the height of the boom; gray forge at Cincinnati, from $8 to $12.50; tank plate, Chicago, from 1.25c to 2.10c; billets from $14.75, Pittsburg, to $24.75; beams from 1.20c, Pittsburg, to 1.70c; Bessemer pig from $9.85, Pittsburg, to $17.40; bar iron from .85c, Cleveland, to 1.40c.

It will be interesting to note in this connection the lowest prices touched in 1897 on the above products—reached in most cases in July—and the prices now current. Local No. 2 foundry, Chicago, has risen from $9.75 to $10.75; gray forge, Cincinnati, from $8.25 to $9; tank plate, Chicago, from 1.10c to 1.20c; billets from $13.75, at maker's mill, Pittsburg, to $16; beams from .90c, Pittsburg, to 1c; Bessemer pig iron from $9.25, Pittsburg, to $10.50; bar iron from 85c, Cleveland, to 1c. Comparing the prices of to-day with those at the lowest point in the year, and comparing both with those which prevailed at the lowest point early in 1895, when the depression was at its most acute stage, so far as iron and steel are concerned, and it will be seen that the advance thus far made is exceedingly modest.

What the high point of the present movement will be will be decided, as in other like periods of advance, by the relation of supply and demand. In some lines consumption is to-day in excess of production. Without going into the presentation of some of the facts relative to prospective demand and the ability of producers to meet it with reasonable promptness, it may be said in general that if the present combination of conditions came in the beginning rather than in the waning of the year,

scarcely an element would be lacking for a rapid advance to measurably higher levels in all lines.

AN INTERESTING EXPORT EXHIBIT.

The statement of iron and steel exports from the United States in July, just published by the Treasury Department's Bureau of Statistics, gives fresh proof of the extension of outside markets for American pig iron and the products of American mills. It is significant of the growth of this trade and of the new lines in which noteworthy records of increase are being made, that the Bureau has adopted a more minute classification of products for the new fiscal year. In the table we give it will be seen that a separate account is now kept of ferro-manganese, billets, ingots and blooms, wire rods, and structural material. Comparing July this year with July of 1896, the increase in nearly every line is surprisingly large, making the total tonnage of pig iron and rolled products four times what it was in July last year. The increase in pig iron, steel bars, steel rails, sheets and plates and nails is worthy of note. It would appear that steel in the form of ingots and billets has not been sent abroad of late to any extent, and this tallies with a statement made in the recent symposium in these columns relative to export trade, in which attention was called in the same connection to the fact that the more finished forms of material found larger access to foreign markets. The table below will be found of interest beyond that attaching to the average statistical exhibit:

EXPORTS OF IRON AND STEEL FROM THE UNITED STATES—GROSS TONS.

	July.		Jan.—July.	
	1896.	1897.	1896.	1897.
Pig iron { ferro }	3,023	1,489	18,113	1,489
Pig iron { all other }		14,532		136,441
Scrap	380	7,154	695	22,745
Bar iron	200	323	2,583	3,668
Steel bars (not wire rods.)	381	1,217	1,912	35,191
Iron rails	16	300	456	4,293
Steel rails	4,962	14,539	22,057	67,112
Billets, ingots and blooms	(a)	754	(a)	754
Hoop, band and scroll	4	39	149	300
Wire rods	(a)	1,920	(a)	1,920
Iron sheets and plates	53	392	368	1,840
Steel sheets and plates	52	324	415	1,334
Structural material	(a)	1,026	(a)	1,026
Wire	2,957	3,625	18,900	29,623
Cut nails	909	2,472	6,306	9,104
Wire nails,	238	875	2,431	3,421
Other, including tacks		186		
	13,175	51,157	74,385	319,261

(a) Not separately stated prior to July, 1897.

The shipments of pipe in July were valued at $225,000. The tonnage is not given. Now that American manufacturers of wrought pipe have established offices in London, a steady increase in shipments of this material may be expecetd.

While the export value of the products enumerated above was $383,203 for July 1896, it rose to $1,321,565 in July of this year, a gain of nearly $1,000,000.

THE CLEVELAND DISTRICT.—Continued fro m Page 3.

iron market is stronger and advancing. Inquiries for lots of 50 to 300 tons are numerous and $9.50 for No. and 10 for No. 1 are now firm quotations as valley furnace, with some sellers asking 25 cents higher.

Bessemer	$10 50@10 75	Valley Scotch No. 1	$10 65
No. 1 Strong Foundry	10 50@10 65	Valley Scotch No. 2	10 15
No. 2 Strong Foundry	9 90@10 15	Gray Forge	9 65@ 9 75
No. 3 Foundry	9 40@ 9 50	Lake Superior Charcoal	12 25@12 50

Finished Material. A 2,000-ton contract for structural material is pending in the Cleveland district, and inquiry is made on 1,200 to 1,400 tons of plates and shapes for a vessel which is figured on at Toledo. The probability that a large tonnage of new steel vessel will be built in Lake Erie shipyards his winter is a prominent factor in ore calculationst for another season. In the past week local business in finished material has been without incident as to prices or volume. There is no change in tank plates or beams and channels, all being quoted 1.05c, Pittsburg, in small lots and 1c on large orders. Bars are firmer; 1c, Pittsburg, is more general for steel, and the same for iron, valley or Cleveland. The billet situation at Pittsburg has made a firmer local feeling on billets and rods. The latter are in some demand, with $22 Cleveland minimum. Wire nails are firm at $1.50, Cleveland, and smooth wire at $1.15. In old material considerable has been done. A sale of old iron rails is reported at $14, another at $14.50. On No. 1 wrought scrap $11.50 net is a firm quotation, and on old steel rails for mill consumption, $10 gross.

Personal.

T. G. Bush, of Anniston, Ala., a member of the monetary commission appointed by the executive committee of the Indianapolis Monetary Convention, is president of the Shelby Iron Co., Shelby, Ala., and of the Clifton Iron Co., Ironton, Ala.

Andrew Carnegie, it is reported, will remain abroad this winter, going to the south of France, to get the benefit of its mild climate. In the spring he will take possession of Skibo Castle, Scotland, which he has leased for the year, with the right to purchase.

Joseph Adamson, head of the firm of Messrs. Joseph Adamson & Co., the well-known boilermakers of Hyde, Eng., is now in the United States visiting leading engineering and iron works, and picking up new ideas in connection with machine tools and engineering plants. Henry Webb, J. P., of the Irwell Forge & Rolling Mill, Bury, accompanies him.

Wm. A. Canty, formerly of the screw machine department of the Pratt & Whitney Co., Hartford, Conn., has accepted a similar position with the Davis & Egan Machine Tool Co., Cincinnati.

D. M. Clemson, superintendent of the Carnegie Natural Gas Co., was added last week to the board of managers of the Carnegie Steel Co., Ltd., to succeed John Pontefract, resigned.

C. A. Chapman has recently established himself at 1,020 Monadnock Block, Chicago, as a consulting engineer, paying especial attention to street railway, lighting and power plants. Mr. Chapman designed and constructed the lighting and power plant of the Akron (O.) Street Railway & Illuminating Co., and the power plant and car house of the Suburban Railroad, of Chicago, and has at various times been in charge of other important work.

Shafting Manufacturers' Meeting.

The manufacturers of cold rolled shafting met in Cleveland Friday, Sept. 17, to take steps toward the formation of a new association. For some months the association, which was organized in 1895, has been inoperative, and at the meeting of last week a reorganization was effected on the old lines, with the Cleveland Rolling Mill Co. added to the original number. In common with bar iron and steel and other products, shafting was sold at unprofitable prices in the first half of the year. The effort of the new association will be to maintain a minimum price. An executive committee was chosen, composed of representatives of Jones & Laughlins, Lt., the Cleveland Rolling Mill Co., and the Mahoning Valley Iron Co., and a further meeting will be held in Pittsburg in the third week in October. Meantime questions affecting the co-operation of two concerns with the association are to be settled.

THE plant of the Shenango Valley Steel Co., at New Castle, Pa., which has been undergoing extensive repairs and additions for some time, resumed on Monday. New trains have been added, and in the future they will be able to supply billets from 1½ inches square, and also sheet and tin bars of any width and length. The Bessemer plant is now one of the most complete of any in the country.

A LIFTING BLAST-FURNACE TOP.

In *The Iron Trade Review* of June 24, 1897, illustration and description were given of a new safety top for blast furnaces, designed by Mr. F. H. Foote, of the blast furnace department of the Illinois Steel Co. Its object was to reduce the dangers attending the sudden formation of explosive gases, by instantly relieving the pressure and permitting explosive gases and the resultant flames to escape without damage to the furnace or injury to the operatives. A further improvement devised by Mr. Foote is shown in the accompanying illustrations. In brief, it consists in an arrangement by which the bell and connected parts, together with the hopper, may move upward under the pressure of an excessive accumulation and explosion of gas. Thus a large opening is provided below the platform, permitting the prompt release of the accumulated gas.

In referring to the devices heretofore provided—the circumscribed openings of limited area, covered normally by valves—Mr. Foote says that it has been impossible with these to preserve tight joints and to prevent the forcible blowing out of the bell, hopper and other parts of the top, with resulting destruction of life and property. This latest improvement amounts to the uncovering of the top of the furnace stack automatically, and the automatic re-seating of the bell and other parts when the excessive pressure of gas has been released.

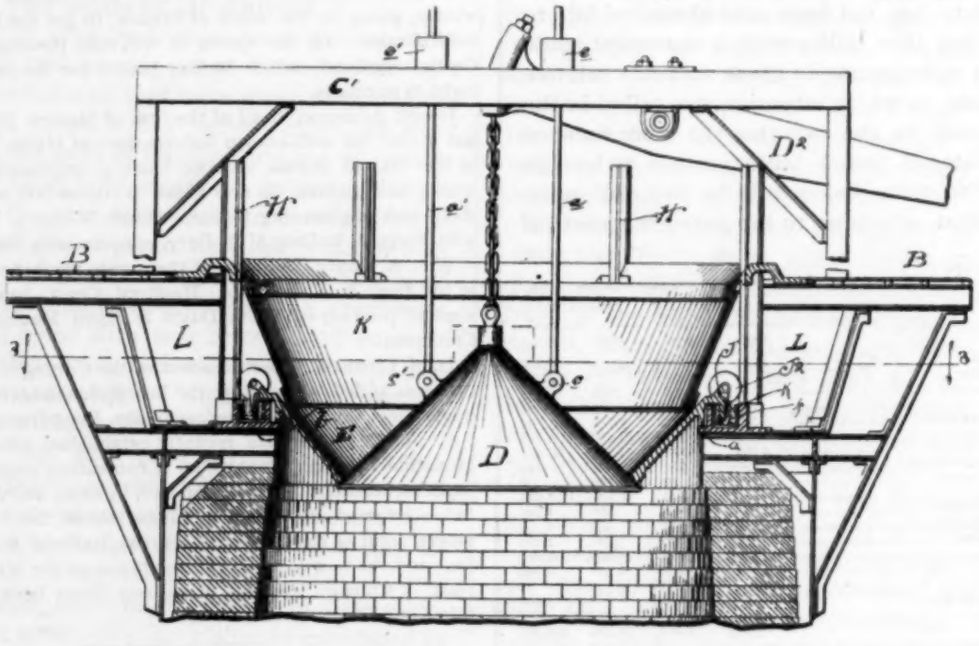


FIG. 1.—IMPROVED BLAST-FURNACE TOP. ORDINARY POSITION.

Fig. 1 is a central vertical section through the top of a furnace, showing the associated parts in position for ordinary use. Fig. 2 is a like view showing the associated parts in a position to release the gas. The top portion of the wall of the furnace-stack is designated at A. Supported therefrom by the I-beams and T-beams is the platform upon which the operatives are at work while engaged in dumping the stock into the furnace-stack. The bell of the furnace-stack, D, is of usual construction and is operated by the rocking lever D^2 in the usual manner, the bell being lowered in order to dump the stock deposited on the bell into the stack.

The bell is supported through the medium of rods *a a'*, suitably connected to the upper surface of the bell or to ears or lugs *c c'*, secured to the bell and projected from it. These rods project upward and through and beyond a suitably-supported beam C', the upper end of each rod being provided with a securing device *e e'*, normally resting upon the upper surface of C'.

A hopper E, annular in form, surrounds the bell, which bears upon the lower edge of the hopper when the bell is in position to receive its load, the upper end of the hopper being so formed as to engage over and rest upon the top of the wall of the furnace-stack. Arranged at intervals about the top of the furnace-stack are traveler posts H, which are secured rigidly in place. Held by arms J, secured to the hopper E, are the anti-friction rollers J^2, which travel upon the vertical posts H. Disposed above and resting upon the hopper is an annular hopper-shield K, which guides and directs the stock to the hopper.

This construction does not interfere with the lowering of the bell in the usual way nor with the normal usual operation of the apparatus in and about the top of the furnace. When, however, an abnormal pressure of the gas occurs in the top of the furnace from an explosion or through other causes, the bell and hopper are exposed to the pressure of the gas and are conditioned to move bodily upward and uncover the top of the furnace-stack and permit the free escape of the gas through the wide-open channel or passage formed by the operatives' platform and the top of the furnace-wall.

In the upward movement of the bell, the hopper, and hopper-shield, the antifriction-rollers traveling upon the vertical ways, direct and limit the movements of the parts, and when a normal condition is restored by the escape of the gas these parts are guided downward, cushioning on the gas and returned by gravity to their normal position by means of the guiding antifriction-rollers and the traveler posts or ways. The hopper-shield K serves the purpose of directing all of the dumped stock into the hopper and prevents any escape through the passage L. This hopper shield rests within the hopper along its lower edge and bears against and is held in place by the traveler ways at its upper edge, and when the parts are bodily raised this upper edge rides upon the traveler-posts.

Provision is made for sealing the annular joint between the upper portion of the hopper and the part on which it rests, in a way that will permit ready separation.

THE old ship is on a new tack and the sails of business are beginning to draw under the freshening breeze. Furnaces, mills and factories are starting up with modern equipment and improved products, which are finding a ready market as the weeks go by. To men of affairs who have watched the course of events it is evident that normal consumption has increased prodigiously, and with the tide at flood the demand will be even in excess of the supply. This is not an optimistic prediction, but is based on the thoughtful and mature opinion of those in touch with the staples of manufacture.—[Boiler Maker.

JOSEPH L. SOMERS, of the Somerton Tin Plate Works, Brooklyn, N. Y., has been in Youngstown recently negotiating for the erection of a plant at that place. It is probable that the Brooklyn plant will be removed to Youngstown or some other point in the Central West.

THE CARPENTER ARMOR PLATE PROPOSAL.

Not a little has been said in daily newspaper dispatches concerning the statement of J. H. Carpenter, of Reading, Pa., well known in connection with the manufacture of steel projectiles, that he can manufacture armor plate for $100 a ton. Mr. Carpenter has stated that while in Europe some time ago he saw the workings of a new process for making and casting steel. This process, it is claimed, makes it possible to cast ingots or shapes free from blow holes and obviates the necessity of cutting off a large portion of the ingot to insure solid, homogeneous steel. It is described more in detail in the following which Mr. Carpenter contributes to the *Engineering News:*

"It is a pneumatic process somewhat similar to the Bessemer process, in that the iron is melted in a cupola under air pressure and run from there into a similar converter. The Bessemer and other processes blow air through the molten mass to consume the graphite, and some add the churning and gyrating motions to the mass to hasten the elimination of the carbonic oxide. But the new process discards all these features and blows air only through the slags and scoria as they arise to the top of the molten bath, oxidizing them, and a second set of tuyeres lets in air under low pressure, which, mixing with the gases, causes their rapid combustion, thus generating a heat over the metal which raises it to any desired temperature, freeing the metal from latent impurities and preparing it for alloying and recarbonizing mixtures.

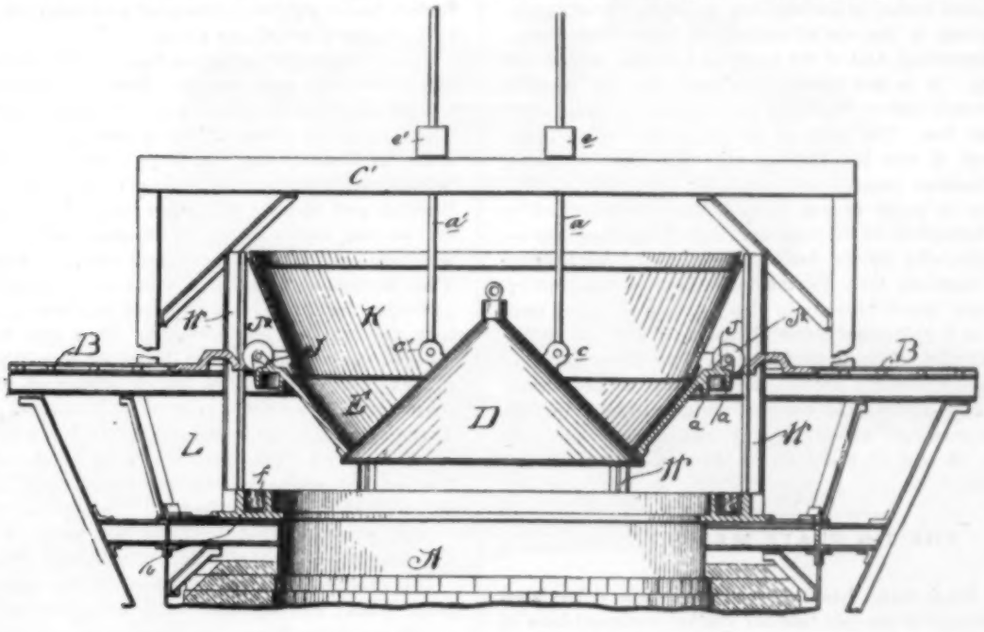


FIG. 2.—BELL AND HOPPER IN POSITION TO RELEASE GAS.

"The shape of the converter and the placing of the tuyeres is to prevent the possibility of the least agitation being given to the metal, and no air is blown into the metal. The elimination of the slags depends upon the difference in specific gravities. The mass of metal is entirely decarbonized in 15 minutes, analysis showing but 0.030 carbon, which is but a trace.

"No air having been blown into the metal, there is no occlusion of nitrogen, which, being incumbustible, attaches in part to the metal, and no hydrogen from the vapor which the air contains, and therefore there is no danger of forming ammonia, which in combination with carbonic acid produces the blow holes and spongy toppings to ingots. The metal thus produced may be poured perfectly liquid with remarkable fluidity into the ordinary sand molds common to the iron foundry. The absence of the usual after reactions common to steel enables the workmen to fill out the molds perfectly, using only enough gatage to be sure of the mold being filled, and in the majority of cases the mold need only be skin dried, and the casts, whether they be ingots, billets, blanks or shapes, are perfectly sound, malleable, sharp on their edges and filled out to all inequalities in thickness without shrinkage cracks and sound in the fillets. Being interested, I spent several weeks with the inventor, visiting the several plants in France, Belgium and England, and satisfied myself fully of the uniformity of product, and by experiments proved the capability of the processes being adopted in making steel of higher grades. The physical condition of the metal, as shown by the test pieces, showed from 65,000 to 80,000 lbs. tensile strength, 38,000 to 45,000 lbs. elastic limit, 28 to 36 per cent elongation, and from 35 to 55 per cent reduction of area. An inch bar was bent double when cold."

In a newspaper interview Mr. Carpenter puts together the cost items as follows, to get his total of $100:

Pig iron of suitable quality	$14.00	per gross ton.
Cost of reducing a charge	3.50	" "
Alloys, etc.	5.00	" "
Heating and forging	15.00	" "
Care of scrap	5.00	" "
Steam power and fuel	13.00	" "
Tempering	2.50	" "
Average machining	20.00	" "
Bending and handling	10.00	" "
Administration	10.00	" "
Total mill cost	$100.00	" "

Adding 6% interest on the cost of of plant etc., at $1,000,000 wou'd be $60,000 per annum; minimum of manufacture, 3,000 tons, would place the interest cost at $20 per gross ton, making the total $120 per gross ton; adding 25% as dividends, which will be $30, will make the grand total $150 per ton; adding 100% the total would be $240 per ton, and the price would not be unreasonable when compared with the price allowed by law.

No allowance is made in Mr. Carpenter's cost estimate for depreciation, renewals and additions. Nor is there anything to indicate that the $1,000,000 allowed for cost of plant is more than a guess. The estimates made by the armor plate commission now engaged in investigating the feasibility of Government ownership are reported to be in the neighborhood of $3,000,000. Experience has shown that a 6 per cent allowance for depreciation and renewals is very conservative. This omitted item would mean $60 a ton on the presumed output of 3,000 tons a year, on a plant costing $3,000,000. Yet for four years the average amount of armor turned out at one of the two plants in Pennsylvania was but 1,549 tons, which would mean $120 a ton for depreciation and renewals alone. Those who have been making figures to show at how low a price armor plate could be manufactured compared with the price that has been in vogue, forget that each of the two plants which were erected at the instance of the Navy Department and after much solicitation by Government officials, must get a return on the investment. A double investment was made and therefore double depreciation and renewal must be figured.

But returning to the process proposed by Mr. Carpenter. As the *Engineering News* points out, it is not unlike various modifications of the Bessemer process which have been exploited from time to time but have never secured any good foothold in the metallurgical world. The merit of the process is greatly overestimated in the newspaper accounts. The metallurgical features of armor plate manufacture in the United States have been in the hands of some of the most capable men who have had to do with our marvelous development of economies in steel-making. It would be asking much

to expect the steel world to take any man's *ipse dixit* on such broad generalizations as are presented in Mr. Carpenter's price schedule. Every investigation of this question has developed the fact that the great item of expense in armor plate manufacture is not in assembling materials, nor in the processes of steel-making, of forging, tempering and other mill manipulations, but in the expensive equipment required and the small tonnage which becomes the divisor into the erection, depreciation and renewal aggregate.

On the claims made on the metallurgical side of the so-called "new process," the *Engineering News* makes this pertinent comment:

"Whatever advantage there may be in blowing the blast of air into the superincumbent slag instead of directly into the molten iron, such as the prevention of the occlusion of nitrogen, hydrogen and ammonia, already appertains to the open-hearth process, and it does not seem possible that metal decarbonized in a Bessemer converter by blowing air into the slag can be any freer from gas which causes blow holes in the ingot than metal decarbonized on the bed of an open-hearth furnace by the passage over the slag of a great volume of highly heated air. Even if the new process should avoid, as is claimed, the necessity of enormous sink-heads, and should save therefore the great waste known as 'toppage' now amounting to 60 per cent of the ingot, this saving is not so great as would at first appear. The 60 per cent of the weight of the ingot which is cut off the top to insure that the remainder be solid metal, is not lost, but is melted over again, and the only loss is the cost of cutting off, labor of handling, the cost of remelting, and of the ferro-manganese used in the recarburizing. It is not likely, therefore, that the topping increases the mill cost of the ingot used for armor plate more than $10 per ton. The cost of making steel by the open-hearth process is now but little greater than that of making it by the Bessemer process, and whatever advantage the latter may have in point of cost is more than overbalanced by the greater reliability of the open-hearth in producing any required quality, and by its facility for using its own scrap. We think, therefore, that if armor plate is to be obtained by the government more cheaply in the future than it has been in the past, as is quite likely, the cheapening will not be due to the substitution of some modification of the Bessemer process for the open-hearth process, but to other causes, rather financial than metallurgical, chief of which will be a diminution of the percentage added to mill cost for wear and tear and interest on cost of plant, and a diminution of manufacturer's profits."

THE TIN PLATE MARKET.

Although the demand has been very moderate, it has been sufficient to impress the fact that the market is almost bare of spot stocks in standard sizes and weights. This condition prevails both East and West, and is likely to continue for some time, with a gradual hardening of prices for September and October plates. The ouput of mills in the last six weeks has in most cases been less than expected and there is consi-derable complaint heard in regard to late deliveries.

The market for future deliveries continues comparatively dull. There is a wide range in sellers' views, comparatively few taking any interest in the low prices at which business is being done. The lowest prices available show but a slight change in the figures that have ruled for futures during the past 30 days. Sellers are not pushing for business, and are particularly shy of far-future deliveries. It is felt tin plate must share presently in the advancing tendency noticeable in other kindred lines. We can, however, note no material increase in the consumption of plates. Trade from jobbers and can makers has not been up to expectations. The pack of canned vegetables now drawing to a close shows decreased output as compared with recent seasons, and resulting prices for this season's pack will certainly mean preparation for using a much larger quantity of plates in 1898 than the can industry demands this season.

Considerable business is being done for deliveries as far ahead as May and June, 1898, and from present indications these contracts should prove good ones for the buyers, as there seems little possibility for any material cut being made in prices at which tin plates are now being offered.

We quote for deliveries January to June, 1898, as follows, f.o.b. maker's mill, Indiana district:

CHARCOAL TINS.

	IC	IX
Lisvane Grade,	$3.60	$4.35
Calland Grade,	3.80	4.55

COKE TINS.

IC, 108 lb. Basis weight,	$3.15
100 lb. " "	3.05
95 lb. " "	3.00
90 lb. " "	2.95
85 lb. " "	2.90
80 lb. " "	2.85

TERNE PLATES.

IC, 216 lb., 20 x 28	$6.05
200 lb. "	5.75

From 10c to 15c concession is made from these prices for Oct. 1 to January 1 deliveries.

LAKE SUPERIOR IRON MINES.

Corrigan, McKinney & Co., who operate the Sunday Lake mine on the Gogebic range, have notified the fee owners that they will surrender the lease Dec. 1, finding it impossible to operate the property at a profit on a 40 cent royalty.

The Queen Mining Co. has stopped work at its No. 1 shaft, dispensing with 200 men. The Regent is the only working of the company. Shipments for the season will be about 200,000 tons. The probability is that the Buffalo and South Buffalo leases will be surrendered and attention given entirely to the western end of the group.

Concerning the telegraphed report of the discovery of a mine east of the Hale near Biwabik, Minn., "containing 40,000,000 tons of ore," the *Mesaba Range*, published at Biwabik, says: "The facts are these: About a year ago Henry B. Stephens & Co., of Detroit, who own large blocks of timber land on the Mesabi range, the greater portion of that land lying between Biwabik and Mesabi, decided to explore their lands for mineral on their own account. They sent here John B. Johnson, who employed Cole & McDonald to do the diamond drilling. They worked on these lands about a year, partially exploring 37 forties, including one forty near McKinley and the old Mallman explorations near Mesabi. They also sunk some drill holes on their property near the Little Mesabi property, about midway between Biwabik and Mesabi, and found some ore there. But it was not of good quality, running about the same as the ore at the Little Mesabi, which is low in iron and high in phosphorus. The ore found may be of value some time, but not soon unless future explorations show up some of better grade than has been found."

The report that at the Lone Jack mine the Oliver Mining Co. is approaching the end of the workable ore is denied.

It is probable that the output of the Mahoning mine at Hibbing, Minn., will be considerably increased next year.

Officers of the Minnesota Iron Co. and of the Duluth & Iron Range Railroad have been on a tour of inspection recently. The No. 2 dock at Two Harbors will probably be rebuilt, making it larger and more completely modern. Some additions will be made also to the rolling stock of the road.

On a recent Sunday and Monday, ore shipments over the Duluth, Mesabi & Northern docks at Duluth were 41,238 gross tons.

The working force in the mines at Ironwood, Mich., is put by the *News Record* at about 1,400 men—600 at the Norrie and East Norrie, 85 at the Ashland, 235 at the Aurora, 200 at the Pabst, and 225 at the Newport. The Norrie stockpiles are being rapidly cleaned up, recent sales having taken up all the ore now in stock or likely to be mined in the next six weeks.

The ore movement on the Duluth, Mesabi & Northern road is lessening, being 650 to 700 cars a day as against 900 to 1,000 cars in the height of the season.

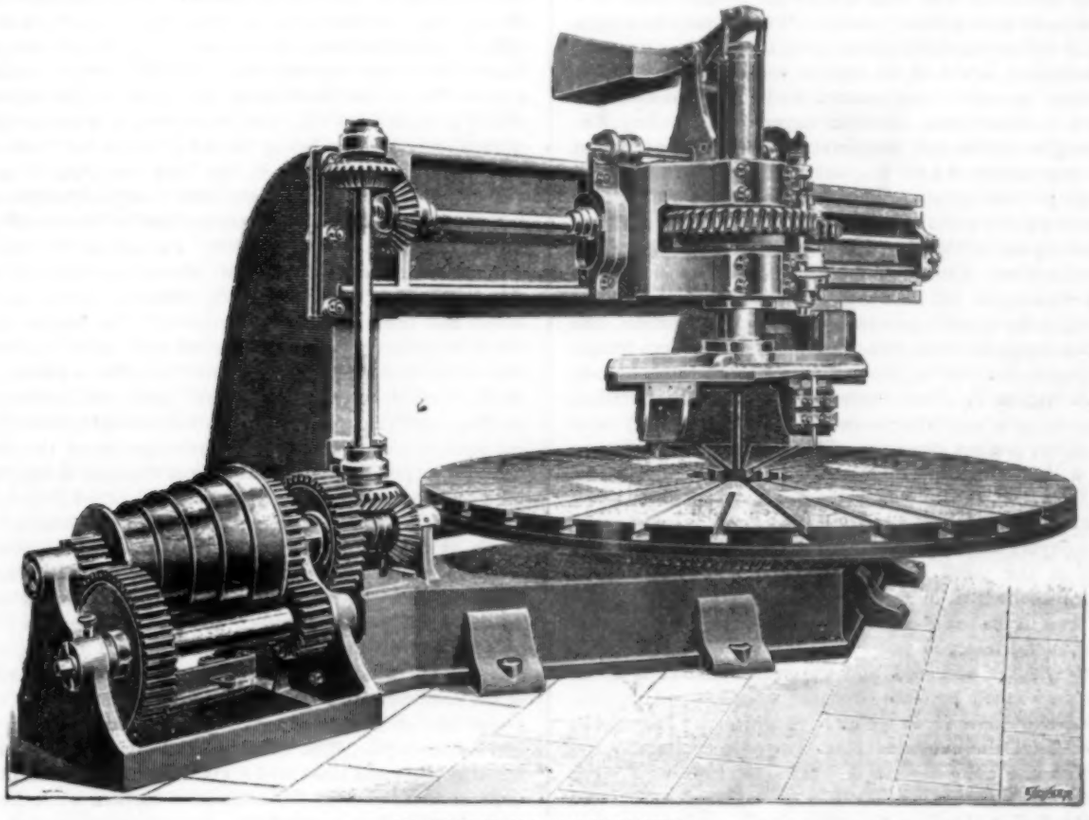
At the Genoa mine a record of 227 cars loaded from stockpile in 10 hours was made last week.

A FORT WAYNE dispatch says that a company is forming to take over the Bass Foundry & Machine Co.'s works at a valuation of $1,150,000 and the Bass plants in Alabama and Tennessee at a valuation of $750,000.

THE Bellaire Steel Co's plant at Bellaire, O., started up Sept. 20, after an active campaign of improvement.

MACHINERY FOR BOILER-MAKING.

The advance in boiler making as compared with the practice of only a few years ago is very marked, and the result is plain to all who have to use steam. Special machines are provided for almost every detail and the life of a modern steam boiler is much longer than when much ruder methods of knocking them together, so to speak, prevailed. The engraving shows a machine designed to plane the edge of boiler ends and cut the circular and oval holes with which they are furnished. The cross beam is carried by two stiff columns, which are bolted to a heavy triangular bed-plate, on which the plate to be operated on is laid. When turning up the edge of a plate, the table is revolved by worm gearing; one of the tool holders upon the double arm being used, while the arm is rigidly held in position by a bracket rigidly bolted upon the under side of the cross-slide. When cutting round or oval holes, which can be done in any part of the plate, the table is at rest, the spindle and double arm revolve. The cutting-out spindle is carried by a strong saddle, is balanced and driven



MACHINERY FOR BOILER MAKING.

by worm-wheel and worm; the saddle is worked upon a bottom slide for taking the wear; is coupled to a dummy saddle for varying the amount of oval, and is movable on the cross-slide, self-acting either way. Each end of the double arm carried by the spindles is fitted with an adjustable tool holder, both being used when cutting round holes, and one when doing ovals. For the latter purpose the saddle is caused to move backward and forward at the same time that it revolves by a crank and connecting-rod. The amount of hand work saved in thick boiler plates by such machines is very great.—[The Engineer, London.

An English View of Southern Iron Exports.

An English exchange comments thus on some considerations that enter into the question of permanent exports of Southern iron: "It is certain that if the exportation of Alabama iron is to be permanent a great deal more care must be taken in grading it. In England we are more accustomed to buying iron of uniform composition than has been the case in some parts of the United States. The composition of some of our best-known brands is so well established and so widely known that iron can be sold on the understanding that it will be practically the same as one of these irons. The iron from Alabama must compete with pig irons that have given satisfaction for years, and that cannot be displaced without a severe struggle. Just now this struggle is based on the difference in cost between English and American iron, but unless careful grading is given to Southern iron the question of cost will not continue to be the main consideration. There are two things that enable a new producing district to invade, capture, and hold markets that have hitherto drawn their supplies from older districts. These are, first, cheapness, and second, excellence and uniformity of product. In times of depression the first consideration may and often does play the chief part. But, in the long run, the second cause becomes the more important, as it is certainly the more lasting."

Making a Start in Steel Wagon Roads.

In accordance with the desireof the Secretary of Agriculture to promote more extended experiments in the use of steel trackways on wagon roads, the office of road inquiry has made arrangements with the Cambria Iron Works, of Johnstown, Pa., for rolling special rails for this purpose, these arrangements to go into effect as soon as definite orders from responsible parties amounting to one mile of track are received. The director of road inquiry and the engineers of the iron company, after much discussion, have agreed upon a plan of track which promises to meet all requirements. It uses no wood in construction and no cross-ties for support, but consists of a simple inverted trough or channel of steel for each wheel with a slightly raised head on the inside to guide the wheels, each channel resting in a bed of gravel and the two tied together occasionally to prevent spreading. Special devices for remounting are provided at each joint. the bearing or tread for wheels is eight inches wide, the thickness about seven-sixteenths of an inch. The weight of the structure is about one hundred tons per mile of single track road and it will be furnished in small sections at the rate of $3,500 per mile. The first order for track has been given by the New York State Agricultural Experiment Station.

THE Peerless pipe threading machine made by the Bignall & Keeler Mfg. Co., Edwardsville, Ill., has been installed on the two new dredge boats Epsilon and Zeta, built for service on the Mississippi River. Peerless machines have also been bought lately for the War Department at Fort Leavenworth, and by the pentitentiary at Joliet, Ill.

CONDENSED FROM THE TECHNICAL PRESS.

Abnormal Changes in Length of Steel and Iron due to Heating and Cooling.—[*Dingler's Polytechnisches Journal*, April 30.]—A long article on the above subject by G. E. Svedelius is of considerable interest in connection with the carbon and texture changes in steel and iron, as a consequence of heating and cooling processes. The investigations described were intended to be a contribution to our knowledge of the peculiar physical changes in the constitution of irons and steels, which occur suddenly when they are brought up to certain temperatures, as well as those which take place during the gradual cooling afterwards. The fact that combined carbon in steels exists in two forms was established by Rinman, in 1865, who found that while cold hydrochloric acid dissolves nearly all the carbon of a hardened steel, a considerable proportion of the carbon in an annealed steel, when thus treated, remains insoluble. Brinell's and Barrett's investigations in relation to the "recalescence" of steel are now given, and a very simple method explained by which any one can observe this remarkable phenomenon for himself. Take a piece of steel wire and heat it to bright redness while in a dark room, and then allow it to cool. When it reaches a dark red heat, it will suddenly brighten up again for a few seconds, and then darken again in the regular cooling process. This phenomenon is called recalescence and is due to a sudden giving out of latent heat. Further experiments by Prof. Osmond brought out the fact that the chemical change of cement to hardening carbon at 1,300 degrees F. is accompanied by an absorption of heat while cooling to 1,220 degrees F., which corresponds to the point of recalescence, and with the giving out of heat again, marks the return of the hardening back to the cement carbon. Prof. Osmond's investigations were made not only with steels, but also with pig irons, electrolytic iron, and wrought irons with various percentages of carbon. In working on the soft irons, two and sometimes three breaks were noticed in the cooling process, none however being lower than 1,220 degrees F. Prof. Osmond attributes these critical points to a molecular rearrangement of the iron itself independent of the carbon changes. This is the allotropic theory of iron, a theory which supposes that iron can exist in two distinct forms: *a* iron which is the ordinary soft iron, and *b* iron which is brittle and hard. Heating soft *a* iron is supposed to convert it to the hard *b* iron, the carbon change taking place at the same time. Quenching, according to the theory retains the iron in the *b* form, while holding the hardening carbon in the same combination with iron which existed while the metal was red hot. This theory is however by no means universally accepted, and the whole matter is at the present time a much and ably debated question. A number of references are now given which have particular bearing on the subject, and the methods made use of in conducting the experiments are fully described. The materials used were partly cold drawn steel rods with 0.90 to 0.10 carbon, and partly hot rolled steel rods with carbon from 1.00 down to 0.10. The expansions and contractions were measured by a dilatometer of special construction, for a description of which the interested reader is referred to the article in question. It is of excellent design, and makes use of a mirror apparatus to magnify the variations in length, and photographic methods to record them. The sensitive paper is coiled on drums which are revolved by clockwork, thus introducing the element of time into the experiments. Temperatures were measured by the Le Chatelier pyrometer, and its mirror apparatus was so adjusted that the beam of light was reflected on the same paper, and the curve of temperatures were made to come just over that of the expansions and contractions.

In this way the actual measurements were magnified 500 times and after the necessary connections for inequalities were applied, concordant results were obtained. Unless otherwise stated the steel rods were heated to bright redness and allowed to cool very slowly. In a comparative test of copper rods with steel ones, the temperature curves of copper were found to be perfectly regular, while those of steel showed two breaks, one in the heating, the other in the cooling. To determine the influence of carbon on these critical points experiments were made with a .90 carbon, or hard steel, a .50 carbon, or soft steel, and a soft iron wire with .10 carbon. The results show that the contraction at the critical point of heating (at which heat is absorbed and thus made latent) is much smaller than the expansion at the critical point of cooling (the point of recalescence, when the latent heat is suddenly given out). The contraction while heating, as above mentioned, takes place at the same temperature for all the rods, but the lower the carbon the longer it lasts. Similarly the expansion at the point of recalescence lasts longer, the lower the carbon, but occurs at higher temperatures. The expansions and contractions at the critical points are greater in the soft steels, and less in the hard steels and soft irons. It seems that in the case of soft wrought iron the contraction at the critical point while heating consists of two moments, the first of which does not last long, and occurs at a lower temperature. The expansion at the critical point of cooling also consists of two distinct moments in the case of low carbon irons. In the case of low carbon steels, they partly overlap, and in hard steels but one can be distinguished. Other points to be noted are these:

Unless the temperature of the metal has been raised to the critical point of heating, the expansion at the critical point of cooling would not take place, and the higher the original temperature, the more marked the expansions and contractions at the critical points. Long continued heating at very high temperatures reduces these effects, and in the case of .10 carbon iron, the contraction at the critical point of heating is drawn out very long. It was further noticed that a repetition of the process on the same rod also reduced the effects produced, so that the expansion of a rod at the point of recalescence after being heated 40 times for a few seconds only and then slowly cooled, was only two-fifths of the original, and in the case of electrolytic iron 50 repetitions wiped out all traces of both critical points, and left the metal with all the characteristics of burnt iron. In fact, all the burnt irons tested lacked the critical points above described. Comparative tests were now made with annealed steels and steels which had been previously hardened. The results indicated much irregularity for the hardened steel series, and incidentally substantiated the theory that in order to harden a steel at all, it must be heated at least up to the critical point of heating, and quickly cooled at a temperature above the critical point of cooling. A critical investigation of the temperatures corresponding to the abnormal changes in length of the high carbon steel rods at the above described points, gives a range of 9 degrees F. at the contraction while heating, and as much as 36 degrees F. for the expansion at the point of recalescence. The lower the carbon the less the range. It seems, moreover, according to Prof. Osmond, that when hardened steel is heated between 400 and 950 degrees F., latent heat is set free, most of which going around .650 degrees F.

A series of tables is now given showing the approximate value of the coefficient of expansion of iron and steel for a range of temperatures from 32 to 1,475 degrees F., with the various carbon percentages. The conclusions derived from these tables are that between 1,100 and 1,475 degrees F. the coefficient of expansion varies with the amount of carbon, while from 32 to 1,100 degrees F. it is constant. For hardened steel this coefficient is very much smaller than for annealed steel, and the smallest value ranges between 200 and 400 degrees F. A remarkable characteristic of hardened steel was found to be the fact that heating it up to a temperature between 300 and 825 degrees F. and then cooling it slowly produced a contraction, thus leaving the rod shorter than it was before. A discussion of the phenomena observed now follows, in which the author says that in his opinion the contraction while heating, and lowering of temperature, may result from the rearrangement of the molecules in the steel concomitant with the destruction of the crystalline structure, and an absorption of heat due to the change of cement to hardening carbon. The expansion while cooling, and raising of the temperature, may be due to the reconstruction of the crystalline texture, and the giving out of heat in the change of hardening to cement carbon. The following observations conclude this interesting and elaborate paper: Because the contraction at the critical point of heating was found to be smaller than the expansion at the critical point of cooling, or at the point of recalescence, it does not follow that the values of the total differences in length are not the same, as the changes in the texture do not occur all at once, and hence are not bound rigidly to the interval of time in which the observed abnormal contractions and expansions take place. Consequently the changes taking place outside

of these critical points may cover up the remarkable differences observed. Again, if a rod is brought up to a temperature below the critical point of heating, there is no destruction of the crystalline texture, and consequently there can be no subsequent reconstruction or abnormal change at what would otherwise have been the point of recalescence. If the rod had been heated to just the critical temperature of heating, only a part of the texture would have been changed, and the reconstruction would not have been as marked on cooling as it would have been had the original heating been carried to a point which would insure a complete destruction of the crystalline structure. Repeated or long-continued heating at high temperatures makes iron coarsely crystalline. It seems that after the regular crystalline structure has been destroyed in carrying the rods beyond the critical point of heating, a second crystallization takes place, which becomes more permanent as the heating continues, thus withdrawing more and more of the mass from liability to structural changes due to heating and cooling. The abnormal changes consequently become less and less until they cease in the case of burnt iron. It would seem a pity to the reviewer that the author did not extend his investigations on just this point, tracing the oxygen taken up by the iron and steel each time the process was repeated, and thus throwing light on an almost unexploited line of research. Many mysterious occurrences in steel mills could be traced to the presence of oxygen in the metal, and a consequent loosening up of the crystals, brought on by carelessness or accident; and it is a wonder that the amount of oxygen is not regularly called for in important specifications. Further notes on these experiments show that the changes in texture are not so sudden, and as the changes in length and temperature come together, no deductions can be made regarding the relation of the carbon changes to the molecular changes, in this line of research. In heating hardened steel, only so much of the mass can crystallize as corresponds to the temperature it was brought up to. To crystallize out more, a higher temperature must be attained, of course allowing for the fact that long-continued heating at the previous temperature may allow a further crystallization also. M.

Profits of Nickel Iron Alloys.—[*Baumaterialienkunde*, July, 1897.]—Extracts from a report on nickel iron alloys, made by Dr. Wedding and Prof. Rudeloff, are given, among which the following data may be of value: The ingots, numbering 39 in all, were calculated to contain from nothing to 100 per cent of nickel. Actual results gave .05 to 98.39. Test pieces were cut directly from the ingots. As the percentage of nickel went, up the coefficient of expansion on heating went down. This only holds good up to 16 per cent of nickel, for with nearly pure nickel the facts are the other way. The limit of proportionality, elastic limit, and ultimate strength, reach their maximum with 8 per cent nickel in the iron. The elongation decreased as the nickel went up, but at 60 per cent it recovered again. The fracture of alloys with less than 1 per cent of nickel showed a tendency to blowholes, which however disappeared when this limit was overstepped. From 1 to 3 per cent nickel the fracture was finely lamelar. Above 3 per cent the ingots began to show a granular crystalline structure, which finally went over into a sharply defined needle-formed crystalline texture. Sixty per cent nickel again formed an exception, having the finely lamelar structure, and with 30 per cent nickel the ingot centers contained oxidation products. Cold bending tests give poorer results, as the percentage of nickel goes up, and as could be supposed the resistance to shearing increases with the nickel up to 30 per cent, and then drops again. A set of tables is finally given showing the effect of hammering and rolling the various ingots down to rods. This shows that up to 16 per cent nickel the ingots could be forged fairly well, but rolling was difficult above 5 per cent. M.

At the annual meeting of the stockholders of the Brown-Bonnell Iron Co. held Sept. 15, at Youngstown, O., the following board of directors was selected for the ensuing year: Messrs. Samuel Mather, Robert McCurdy, H. C. Bughman, Henry Wick, John I. Williams, Daniel Eells and Joseph Forker. The board elected the following officers: Samuel Mather, president; Robert McCurdy, vice-president; John F. Taylor, secretary and treasurer; J. M. Butler, assistant secretary; John I. Williams, general manager.

THE AMERICAN BLOOMING MILL.*

BY RALPH CROOKER, JR.

The Bessemer and open-hearth processes are the survivors of many attempts to produce a cheaper or better material than that produced by puddling. When these new methods of working iron emerged from the wholly experimental stage and became accepted commercial facts, they found the iron and steel industry already in a highly developed state. The crucible steel process was then about as perfect as it is to-day; while the making of puddled iron, stimulated to the highest degree by the building of railroads—which it had made possible—had reached a point which it has since excelled but little, if any, in quality; although for some years afterwards it continued to increase in quantity.

It was to the machinery prepared for the handling of these materials, crucible steel and wrought iron, that the first ingots of the new processes—at first almost exclusively Bessemer—came to be worked into the shapes that afforded the best market for them, or which stood most in need of such improvement in quality as they offered.

In England, where the greater part of the early development of the Bessemer was done, the ingots were at once sent to the hammer, and submitted to the same treatment as the crucible steel. I am unable to find that any attempt was made to roll it direct from the ingot during the first few years of Bessemer practice; a fortunate circumstance, I think all will agree who are familiar with the characteristics of that early steel. The product of an English Bessemer works at this time, the middle sixties, was so small—from 100 to 200 tons per week—and relatively of so little importance in the large English and continental works, that the need of machinery especially to care for it does not seem to have been felt. It was a very simple matter to add hammers as the product of the Bessemer works increased, which it did very rapidly, and this was the universal practice, persisted in until the forge department of some of the works attained tremendous proportions, one firm alone having 70 hammers in use before abandoning the system, and making little or no change except to strengthen them and increase the size from four to five, and then to seven and 10 tons.

First Improvement on the Hammer.

The first to undertake the improvement of this state of affairs was Mr. John Ramsbottom. He undertook to improve the hammer itself, and brought out his duplex hammer, which consisted of two hammer heads moving horizontally towards each other on rollers, the heads being actuated by a steam cylinder through links, the ingot worked upon being placed between the hammer heads, and moved in a direction at right angles with their motion. Several of these were put in operation, but they do not seem to have altogether accomplished their purpose, at least they do not seem to have suited Mr. Ramsbottom, for he shortly afterwards introduced his cogging mill, which was one of several devices brought forward at about the same time by different inventors, and the only one of them, so far as I can ascertain, which was ever put in practical use. This mill in its general features was so nearly like the later blooming mills that one wonders how he managed to miss it. It consisted of a pair of huge housings carrying a pair of arbors, to which were bolted segments of cast iron, forming grooves which went part way around the rolls. The two rolls were made to turn in unison by means of pinions keyed to their necks and were driven, through very high gearing, by a small reversing engine. The top roll was counterbalanced by a small hydraulic cylinder in the window of the housing between the necks—an arrangement made possible by the great diameter of the rolls—over five feet—and the top roll was forced down by a wedge driven between the top of the housing and the top box by a hydraulic cylinder, operating through a rack and pinion. The vertical movement of the top roll with this arrangement was, of course, very limited.

American Three-High and English Two-High Mills.

While Mr. Ramsbottom was busy trying to correct the faults of his duplex hammer by building his cogging mill, others who were using them were wrestling with the same

*Read before the Engineers' Society of Western Pennsylvania at Pittsburg, Sept. 21, 1897.

problem, which was forced upon them by the constantly increasing output of their Bessemer works; and the obvious methods of rolling the ingots in the "top and bottom" rolls of their rail mills was tried by several, and with considerable success. With the English rail mills it was an easy matter to do this, and it may be well here to call attention to the distinct difference in practice existing between the English and American mills of the period (1867), a difference which had come about during the preceding 10 years.

Up to 1857 the mills for heavy work—those in America being nearly all rail mills—were the same in both countries, too high and non-reversing, the piece being returned over the top roll. In this year Mr. John Fritz first put in use his hanging guide, which made three-high rail mills possible, and within a few years all the American mills were made three-high. This was not the case in England, however, where efforts were made to improve their two-high mills by reversing the motion of the rolls between passes, so as to work the piece through the rolls in both directions, the means adopted being five gears and a clutch—many kinds of which were used—and later, reversing engines.

So at the latter end of the decade between 1860 and 1870 the universal practice in America was three-high and in England reversing two-high mills. It is not surprising, therefore, that in its first blooming mills each country should have followed the form of mill prevailing at home; but so fixed was the difference of opinion as to their respective merits that each country stuck to its own, without a waver, for the next 10 years, and without, seemingly, caring to know much about the other. When it was shown that ingots could be bloomed successfully on the "top and bottom" rolls, larger reversing mills built especially for the purpose quickly followed, and several were in use at the end of the decade (1860–1870), although hammering was continued in some works for many years.

America did not begin its modern steel making as soon as England and Europe, nor did it advance so rapidly for some time after it began. There were several reasons for this. We were busy with a great war, which absorbed all our energies, most of our money and many lives, costs of installation and production generally were much greater, and uncertainty and dispute as to patent rights made it hazardous to enter upon such undertakings, so it was 1864 when the first ingots were made at Wyandotte and they, like those produced abroad at the same time, were hammered. Troy, Pennsylvania, Freedom and Cleveland, the only other producers of Bessemer steel in that decade, all used the hammer for blooming.

Troy, Cambria and Cleveland Mills.

It was at the beginning of the decade (1870–1880) when the production of Bessemer steel ingots in America had reached 40,000 tons for the year, that the shortcomings of the hammer began to be seriously felt, and the necessity of building blooming mills forced itself upon the steel makers of this country, and the first works to put a blooming mill in operation was Troy, which rolled its first ingots in January, 1871. This mill, following the general practice of American rolling mills, was a three-high mill, being the first three-high blooming mill in the world, as well as the first blooming mill in the United States. Its top and bottom rolls were fixed, the middle roll was carried in a pair of forged steel bolsters and was moved up or down after each pass by four screws driven from the main engine shaft by a belt, shafting and worm gearing controlled by a belt-driven reversing clutch. The tables on both sides of the rolls were raised and lowered together by hydraulic power. The top of the tables was made up of loose rollers, spaced closely, and on these the two rail ingots were pushed straight for the passes and into the rolls with bars and turned with tongs.

About six months later (July 10, 1871) the Cambria Iron Co. put in operation a mill designed by Mr. George Fritz, which had much the same influence on American blooming mills as his brother's earlier invention had had on American rail mills, and fixed the type of mill in almost exclusive use for the decade. This, also, was a three-high mill; but it differed from the Troy mill in having its middle roll stationary, while the top and bottom rolls were movable. The top roll was counterbalanced and the top and bottom rolls were moved towards the middle one between passes by screws acting together; they were, therefore, only obliged to make the full travel, when opening to receive the ingot for the first pass. The important feature however, was the tables. These raised and lowered together by hydraulic power, and the tops were composed of rollers arranged to be driven from the main engine by gearing controlled by friction clutches. Combined with this was a manipulator, which consisted of a small car beneath the table with prongs on top of it, extending up through the table rollers when the table was down; this car was moved transversely to any desired position under the table by a hydraulic cylinder, and by lowering the ingot on to the prongs it could be turned, or by pushing the prongs against the side of the ingot it could be moved from pass to pass. This mill was a notable success.

The next year (1872) the Cleveland Rolling Mill Co. built a blooming mill which deserves mention as the first reversing blooming mill built in this country and also because it was the only one of its type ever constructed here. It was a clutch reversing mill and all the auxiliaries, tables, shears and shear tables were driven from the train engine. As at first put down it reversed with a three-gear clutch; this was afterwards changed to the five-gear system. In both cases friction clutches were used, and I believe that no blooming mill has ever been built here that reversed with crab clutches. English practice largely influenced the design of this mill and at that time the superiority of reversing engines was not established—although it surely was shortly afterwards; but that friction clutches were better than crab clutches for reversing was settled. The engineering periodicals and the records of engineering societies for some five or six years about 1870, are full of illustrations and discussions as to the relative merits of the many devices proposed to overcome the glaring faults of the crab, and are interesting history.

These three mills (Troy, Cambria and Cleveland) may be grouped as the pioneer American blooming mills; but the "Fritz" mill only needs further attention, the others having had no influence whatever on the design of later mills. If the manufacture of Bessemer steel in America made slow progress in the decade of 1860-1870, it quite made up for it in the first half of the next, eight large works being built on much improved plans. These were all intended for the manufacture of rails, and hardly any other outlet for their product was looked for or expected, the power of new railroad enterprises to absorb the product seeming, at the time, to be almost limitless, while the inferior quality of much of the early steel still cast a deep shadow of suspicion on its reliability for other purposes. For blooming ingots, of the size then made for rails, it was, and is still, difficult to improve on the Fritz mill; the size of the ingots not requiring excessive length of tables while the large section of the finished bloom made it possible to do the work on short rolls of comparatively small diameter. Under these conditions it is easy to understand why nearly all of these eight works, built between 1871 and 1876, put in "Fritz" blooming mills, and no other kind of mill had a trial until these conditions changed.

As these mills followed each other in rapid succession, each was an attempt to improve upon its predecessors; but the improvements were entirely confined to minor details. Driving the tables by independent power succeeded various methods of driving from the main engines, operationg the table rollers automatically by V friction wheels, engaging when the tables were in either the highest or lowest position, came into use and was followed by a positive drive by means of gears, lazy tongs and reversing engines; the rolls, however, continued to be movable.

The great expansion of the Bessemer steel rail business between 1871 and 1876 was followed by an equally great depression in consequence of the business panic of 1873, and during the last half of the decade very little was done in new Bessemer construction, the efforts of the steel makers being entirely directed towards economical production, and it was these efforts which led to the first departure from what had come to be distinctly recognized as the American blooming mill. The familiar method of increasing the tonnage was the one almost universally adopted to bring about the desired result, and so successful were the managers of the converting departments in this direction that the product of vessels soon exceeded the capacity of the casting pits to handle it, planned, as they had been, for the work of some years earlier.

First Blooming Mill with Reversing Engines.

Faced with this state of affairs the Cambria Iron Co., in 1878, determined on a radical departure from the prevailing pit practice, which involved the making of ingots much larger than those in common use, and to care for these they put in a mill which deserves attention, being the first blooming mill in the country reversing with engines, and unique in other respects.

When the "Freedom" works was built in 1868 a plate mill had been imported from England with a reversing engine, said at the time to be "the best of its class yet produced." It was this mill and engine, with blooming rolls substituted for the original plate rolls, which the Cambria Iron Co. utilized to work the large ingots. It was, therefore, an English mill; but the tables, which constituted its chief title to distinction, were American, having been designed by the late Mr. Daniel N. Jones. These consisted of large rectangular frames carrying the gudgeons of loose rollers, the bodies of which rested on solid tracks. These frames, with the rollers, were moved to and from the rolls, through a short distance, by hydraulic cylinders. It will thus be seen that when the table, with the ingot resting on the rollers, was pushed by the cylinder towards the mill, the ingot, moving twice as fast, was projected over the end of the table and into the rolls. With this table was combined a manipulator which was very simple and efficient. It consisted of two hydraulic cylinders; one mounted on each side of the table, but independent of it, with the piston rods extending over it and carrying heads so shaped that by forcing them against the ingot it could be turned or moved from one pass to another. A useful feature of this manipulator was that by stopping the mill with the piece in the rolls a crooked bloom could be straightened by forcing one of the heads against it, an important advantage when ingots have been unevenly heated. The screws of this mill were operated by a small steam engine, and the top roll was counterbalanced by hydraulic pressure. It is a singular fact in connection with this mill, with a manipulator in successful use, that none of the numerous reversing mills built were equipped with manipulators of any kind for seven years afterwards.

While the blooming mills built up to this time had all been in connection with Bessemer works and with a view to rail manufacture, the open-hearth process had been steadily developed since 1870, and it is to be noted that from the time when the building of Bessemer works ceased in 1875 until the phenomenal development of new undertakings following the business revival of 1879–80, the building of open hearths was about the only new work done, and the product was at first almost as exclusively devoted to plates as the Bessemer was to rails. The hard times of the last half of the decade forced the Bessemer makers to try to dispose of a part of their steel by rolling their blooms into billets on other mills; at the same time the high quality of the open-hearth metal had created a considerable demand for it; but the open-hearth makers labored under great disadvantages in getting their material into marketable shape, being compelled to cast small ingots and roll them on the larger bar mills. The Fritz patents had passed into the hands of an exclusive corporation, and the small size of the open-hearth works, coupled with the high cost of a blooming mill, made the open-hearth people hesitate before putting in so much capital to do so little work.

First Open-Hearth Reversing Blooming Mill.

At last, in 1879, Shoenberger & Co. put in operation a reversing blooming mill, in connection with their open-hearth furnaces, which was the first to be built except at a Bessemer plant, and also the first to be devoted entirely to the general trade in blooms, billets and slabs. In this mill the grooves in the rolls were of varying depth, the screws were worked by power from the shears engine through a "Hill" clutch and the tables, made of I beam frames and cast-iron rollers, were driven and reversed by the train engine direct, through belts. The rolls were driven by a pair of reversing engines which had previously been used on a gunboat, no reversing rolling mill engines having then been made in this country. This mill is of interest, as the experience gained from it was embodied in the design of the one erected at Homestead two years later, thus having a decided bearing on the development of our modern mills, and, furthermore, because on it were made the first 4-inch billets rolled direct on a blooming mill.

The same reasons which led to the building of the Shoenberger mill caused other open-hearth makers to do the same; but so firmly fixed was the superiority of the three-high mill over the reversing mill, in most minds, that the latter received but little consideration. To use three-high mills, however, the Fritz patents must be avoided, and with this object in view two mills were built, one for Naylor & Co. for billets, and one for the Springfield Iron Co. for rail blooms. The peculiarity of these mills was the table arrangement. At the back of the rolls was a table of loose rollers, lifted directly by a jack; on the front side were ordinary hooks which were raised and lowered by the motion of the back table, but through less distance. A fixed driven roller was placed over the back table in such a way that when the table was raised the ingot was forced against it and thus carried into the rolls.

Another mill should here be spoken of as illustrating the expedients to which steel works managers resorted when the Fritz patents could not be used and before mills reversing with engines were accepted as good practice in this country. It was put in at the Union Works at about the beginning of 1880 and was reversed by the surface friction of large wheels with very broad faces (20 feet and 8 feet in diameter, I think) which were forced in contact by means of a hydraulic cylinder and levers. This mill was afterwards replaced by a modern three-high mill, and should be remembered only as taking the place of the last hammers in the business, and as being the last attempt at reversing in any other way than by engines.

The Modern Three-High Mill.

With the beginning of the decade 1880–1890 came great changes in the business conditions affecting the steel industry, and these were quickly reflected in repairs, improvements and additions to existing plants and the starting of new enterprises. The tremendous business expansion which began late in 1879 continued through 1880–81 and 1882, and the demand for steel works products, especially rails, was unprecedented. This demand came upon works, many of which, during the preceding five years, had been run with the least possible expenditure for repairs and were now driven to the utmost capacity. This usage of machinery quickly made necessary the replacement of several of the earlier blooming mills, while some firms added complete new plants.

In these renewals and extensions the influence of the Cambria practice of large ingots is clearly shown, all the new mills being made larger and stronger, while two mills, a three-high at Bethlehem about 1884, and a reversing mill at Cambria in 1885, following the decided tendency of the time, were made 48 inches in diameter. The conclusion seems to have been reached, however, that equally good results may be obtained from somewhat smaller mills and none have since been set up of over 40 inches.

With this group of new mills the three-high mill reached a fixed standard which we may call the modern three-high blooming mill, the first one embodying all its characteristics, having been put down at Chattanooga in 1878, and since this time no appreciable change has taken place. In these mills the rolls are all fixed, the tables are raised and lowered by a horizontal cylinder connected with L cranks and links, and the table rollers are driven by an independent reversing engine through gears carried by a lazy tongs. How thoroughly efficient this kind of mill has proved itself for the making of rail blooms is shown by the fact that in all the new work intended for rail making, in the decade which we are now considering, all but two were of this description—one at Scranton, and the other at the Cambria works. In this latter case the necessity of making various sizes for other purposes than rails largely governed the choice, and it is of interest that this mill replaced the original Fritz mill.

Of the many new enterprises inaugurated during this period, the works erected at Homestead in 1881 by the Pittsburg Bessemer Steel Co. from the plans of Mr. James Hemphill claims particular attention. This plant, the beginning of the great establishment now located there, was the first Bessemer works especially built to manufacture steel for other purposes than rails; it was also the first to be put in operation after the expiration of the essential Bessemer patent, and in its construction a number of patents, supposed by many to be indispensable, had to be avoided.

In designing the blooming mill the experience gained in

the "Shoenberger" mill—alluded to earlier in this paper—was largely availed of, and several features afterwards generally used in American reversing blooming mills were introduced. The mill was driven by the first American reversing engine intended for rolling mill use; the rolls were made with all the grooves of equal depth, thus permitting the adoption of straight table rollers and the making of many sizes on one pair of rolls, and the roll screws were worked by a hydraulic cylinder through a rack and multiplying gear. The tables were constructed with I beam frames and the table rollers were driven by an independent reversing engine, the ingot being handled and turned on the tables by ordinary hooks hung from above, and tongs. This mill proved itself very efficient, and during the following years many mills of similar character were built, the building of blooming mills receiving great impetus by reason of the change of the material used in cut nails from iron to steel and by the increasing demand for Bessemer billets, which followed rapidly when once they were fairly on the market.

In these mills, about the only changes from the Homestead mill was the substitution of heavy cast iron table frames for the I beam construction, and a simplifying of the table driving gearing. It was on one of these mills, at the Spang Steel works in 1885, that the first manipulator after the Cambria one of 1878 was tried, and after that they came slowly into use.

Another mill which should be mentioned in connection with the new enterprises of this time, is one which was put to work at Scranton for making rail blooms in 1883. This mill, with its engine, was imported from England, and is the only complete mill ever brought from there. It was a good sample of the typical English mill of the time; very heavy and with great power. The tables consisted of loose rollers, their necks running freely on rails, and the ingots were handled on these with tongs. This table arrangement, which was never copied by American mills, was replaced some years later by a modern driven roller table. This mill seems to have had some influence in calling attention to what could be done by increasing the engine power of our mills, which was emphasized later by the work of the Sparrow's Point mill.

With the decreasing requirements for rails in this decade, and the ever-increasing demand for steel for other purposes, the three-high mill, except for replacements in rail works, received but little attention. It seemed to be accepted, as fact, that the two-high mill was best where a wide range of work was to be done. It is for this reason that a mill put down at the Otis works at Cleveland, to combine the advantages of both systems, requires description, being the last of the modifications of the three-high mill.

In this mill the bottom roll was fixed, the top roll was counterbalanced and worked with screws in the same manner as the top roll of a two-high mill, while the middle roll was thrown up and down between passes, as in a three-high plate mill; the collars being made extra wide, to support the middle roll which rested against them when working. The Fritz tables of this mill were 30 feet long, and the only ones of that type ever fitted to a mill for general bloom and billet work.

With the beginning of the present decade, practice had become so established that but one mill may be considered as particularly departing from it. This is the Sparrow's Point mill, which is the only thoroughly American reversing mill which has yet been intended exclusively for rail blooms, and is noticeable chiefly for the great power of its engines, which demonstrated the capacity of this form of mill when properly engined; and since the installation there has been a marked increase in the power provided for mills of its class.

Development of the Two-high Mill.

The three-high blooming mill reached its highest development at about the time that the two-high mill began its career, and within 10 years of its inception; and since that time their number has diminished rather than increased, partly because of a reduction in the number of rail-making establishments, in which field it has maintained its pre-eminence, and shows how thoroughly adapted it was to the purpose for which it was intended.

With the two-high mill it is a story of progressive development for nearly 20 years. We did not begin with this kind of mills until it had been in use abroad for many years, but we availed ourselves little of foreign experience and followed lines of our own, improving and altering our original designs. The first table frames made of I beams were displaced by cast iron with the bearings cast on; these were followed by built up wrought iron and cast iron frames with separate bearings; the present table frame being a substantial cast iron bed plate with the bearings bolted on, and in some instances water-cooled. Table rollers of cast iron with wrought axles cast in were quickly abandoned for the wrought iron pipe roller in general use on the three-high mills; then came the steel casting with the necks cast on, and to-day the preference is divided between these and a roller made of a cast iron body fitted with a forged axle. The driving of the table rollers began by taking power from the main engine, which was soon changed to the use of a separate engine driving both tables together through a countershaft; and finally the countershaft has been done away with, an engine coupled directly to the line shaft being used for each table. At the same time there has been a steady improvement in the table gearing. In the earlier mills the rollers were divided into groups driven by spurs and idlers; the number of these has been gradually reduced until each separate roller is now driven by a mitre gear, and there is not a single intermediate gear or countershaft of any kind in the best mills. Manipulators, after a few trials, superseded the old-fashioned hooks and tongs, and since 1890 have been in general use. In this matter alone there seems still to be difference of opinion, and some half dozen kinds have their advocates. In the mill itself, we have finlly widened the windows of the housings so that the rolls may be changed through them; and we now generally use hydraulic counterbalancing for the top roll—methods which have prevailed in other countries from the beginning, but which we reached rather by evolution than by imitation. For working the roll screws there has been but slight change since hydraulic power took the place of belts and engines, although electric motors are used on some mills requiring extraordinary lift to the top roll. The early mills were driven by engines with gearing of three or four to one; these ratios have been steadily cut down until gearing has been abandoned, and the latest mills are connected directly to the crank shaft.

It seems as though the work of simplifying the two-high mill has about reached its limit, and, like the three-high mill of fifteen years ago, there is little room left for further improvement.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

The Universal Trading Co., of New York City, N. Y., has been incorporated, with a capital stock of $30,000, to manufacture all kinds of machinery. The directors are George W. Munroe, of New York City; J. Ensign Fuller, of Bath Beach, and Solomon S. Sugar, of Brooklyn.

Press dispatches state that a new tin plate plant is projected at Ebensburg, near Johnstown, Pa. The new company will be capitalized at $100,000, much of which will come from Pittsburg. S. L. Reed, of Pittsburg, is interested.

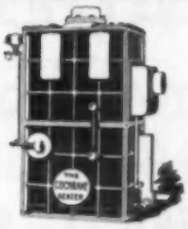
The purchase of new machinery for the machine shops of the Duluth & Iron Range Railroad at Two Harbors, Minn., is under consideration.

The Crowe Foundry & Machine Co., of Middlesborough, Ky., has been incorporated with $5,000 capital stock.

New Construction:—

Zug & Co., Pittsburg, are preparing to roll black sheets for tinning and are now adding the necessary equipment. Two gas producers are being erected by Wm. Swindell & Bros.; a heating furnace and an annealing furnace are wall under way and a pickling vat has been begun. Two additional stands of rolls have been ordered from Mackintosh, Hemphill & Co. An electric lighting plant is being installed and electric cranes will hereafter be used in all departments of the plant. A large warehouse is being constructed fronting on Pike st., and with railroad switches adjacent. The capacity of the plant will be one-half greater than heretofore.

The plant of the Pittsburg Foundry & Machine Co., operated by Velte & McDonald which was recently destroyed by fire will be rebuilt at once and new machinery installed.



COCHRANE HEATERS

There are to-day more feed water heaters in use that are giving their owners a temperature of *less* than 180° than there are giving *over* 180°, and the *majority* of all the heaters in service give no purification whatsoever. Therein are "The Cochranes" different, for they give 208°-210° under normal conditions—with *real* purification—and are made with every regard for convenience in operating and cleaning. Being built of metals that do not quickly deteriorate they *last*—indefinitely—and without repairs. The water and exhaust steam coming into direct contact, their efficiency is unaffected by years of service. Harrison Safety Boiler Works, Phila., Pa.

The Elk Rapids (Mich.) Iron Co. will rebuild its chemical plant, recently destroyed by fire.

The Structural Iron Co., Baltimore, has begun the erection of a plant in South Baltimore. The first building will cover an area 80 x 200 feet and will be one story high. In this machinery will be placed for the construction of material for bridges, roofs, trusses and ornamental work for buildings. Later another building of similar proportions will be erected for the steam, compressed air, and hydraulic plant.

Additions, Enlargements, Removals, Etc.:—

The California Iron & Steel Co. has purchased the plant at the Iron Mine, four miles from Clipper Gap, Cal. The machinery will immediately be removed to the Judson Iron Works, San Francisco.

An addition will be built to the American Tin Plate Mill at Canal Dover, O.

The Tower Mfg. Co., Madison, Ind., is about adding a building, 140 x 42 feet in size, to its nail and tack factory. It will run 100 machines, and give employment to about 75 hands.

Fires and Accidents:—

The Eagle Iron Works, at Eau Claire, Wis., owned by Noah Shaw & Co., have been partly destroyed by fire, involving a loss of $5,000, partly insured.

The foundry and machine shops of B. Suffron & Son, Peebles, O., have been destroyed by fire, with a loss of $6,000, and no insurance.

H. F. Booth's foundry at Candor, N. Y., has been destroyed by fire.

General Industrial Notes:—

The Illinois Central has adopted 100-lb. rails and the company will in the near future begin laying these rails for a distance of four miles at Cairo bridge, and will gradually extend them as renewals are necessary between the Ohio River and Chicago on the main line. This track was laid with new 75-lb. rails in the past few years, and there will be no necessity for renewing much of it for some time.

Wm. Tod & Co., of Youngstown, O., have shipped to the Consolidated Steel & Wire Co. at Rankin Station, Pa., six car loads of rope pulley castings. These are to form a rope pulley 22 feet in diameter, 7 feet and 3 inches across the face, having 34 grooves for two-inch rope. The aggregate finished weight is 125,000 pounds.

The Cambria Iron Co. has declared a dividend of two per cent, payable Oct. 1.

At Anderson, Ind., the American Wire Nail Works resumed with 700 men.

At Massillon, O., C. Oscar Oleson, proprietor of the Oleson Foundry & Machine Works, has assigned. The assets are estimated at $25,000 and liabilities at $15,000.

Alice Furnace at Sharpsville, Pa., was put in blast Sept. 19.

Roughers at the Lindsay & McCutcheon mills, Allegheny, have been on a strike, claiming they do not receive their proper percentage of the tonnage price paid the rollers. The trouble is between the two classes of workers. New men have been secured to take the strikers' places.

The Salem (O.) Wire Nail Works are not to be closed by arrangement with any syndicate. The strike is still unsettled, but the State board of arbitration is making some headway.

The annual meeting of the Webster, Camp & Lane Machine Co., Akron, O., was held last week. John McGregor was elected president and treasurer; S. H. Pitkin, secretary and general manager; J. W. Chamberlain, superintendent. The company has had a good run of business recently in mining machinery and engines and prospects are good.

Car and locomotive building: The Pa. Railroad is building 45 new engines, 15 of which will be ready for service about Oct. 1. It is said that the Pan Handle will require the relaying of 15 miles of track for the running of such heavy engines, and that the Ft. Wayne will need 100 miles of new heavy track. The Kansas City, Pittsburg & Gulf asks bids on 30 locomotives; the Wabash on 25. Missouri Pacific will soon order 25. The Pittsburg & Lake Erie is asking bids on 200 box cars. The Santa Fe has ordered 200 coal cars and 100 box cars. The C. & O. has placed 1,000 box cars with Pullman's Palace Car Co. Southern Railway is in the market for freight cars and an order may soon be placed for 800 box and 700 coal cars. The Colorado & Northwestern is asking bids on 100 ore and 66 other cars.

The Lake Erie Engineering Works, Buffalo, N. Y., were the lowest bidder to supply a 30,000,000-gallon pump to the city of Chicago. Its bid was $83,875.

The Stillwell-Bierce & Smith Vaile Co., Dayton, O., is reported to have orders ahead amounting to fully 125,000 h. p., sufficient to keep the works busy for some time.

McGill & Co., Pittsburg, are shipping considerable machinery abroad. A recent order from Mariopol, Russia, included about 110 tons of steel working machinery. Further shipments to local tube firms include about 15 tons of machinery.

But one of the Henry Clay furnaces at Reading, Pa., has been running the past year and the other has just been started. Both are now running to the full capacity and are turning out about 125 tons of iron per day.

An Allentown, Pa., dispatch says that the Cornet Steel Co., of New Jersey is about to close negotiations for the purchase of the two large mills at Fullerton, Lehigh County, from creditors of the Catasauqua Mfg. Co. The mills will be rebuilt and enlarged in the next few months.

At the Sharon Iron Works, Sharon, Pa., 18 puddling furnaces were started on Monday, making 38 active in all.

One of the two furnaces of the Dayton Coal & Iron Co., at Dayton, Tenn., which has been out of blast for some time, will blow in as soon as repairs now under way are finished.

The forgings in the engine of the torpedo boat Rogers, which was built by the Columbian Iron Works & Dry Dock Co., Baltimore, broke last week, causing considerable damage to the machinery. They are being replaced by forgings from the well-known works of the Bethlehem Iron Co. at South Bethlehem, Pa. It should be stated in this connection that the forgings which broke were not made by this concern.

M. C. Harrison and T. E. Long, of the Pittsburg Pump Co., have purchased the property of the Columbiana Pump & Machine Co., of Columbiana, O., and will operate the plant under the firm name of the Columbiana Pump Co.

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ST. LOUIS, 516 N. Third St. WASHINGTON, Kellogg Bldg.
MONTREAL, J. G. Sibbald, 3 Windsor Hotel.
SAN FRANCISCO, John Woodlock, 26 Beale St.

John Tempst Co., operating the fire brick plant at Courtney Station, on the Monongahela division of the P. R. R. have secured the fire brick plant of the Watson Mining & Mfg. Co., at Gallatin Station, on the Pittsburg & Lake Erie Ry., and the two plants will be operated as the Tempest Brick Co., Ltd. Pittsburg offices have been opened in the Park building, Pittsburg. The officers of the new company are: Victor L. Crabbe, president; A. W. Van Eman, secretary; James Evans, treasurer; John Tempest, superintendent.

Cochrane & Whitehead, selling agents of engines, boilers & steam specialties, have opened offices at 411 Park building, Pittsburg.

Little Belle Furnace at Bessemer, Ala., was put in blast by the Tennessee Co. last week.

The reorganization of the Columbus & Hocking Coal & Iron Co., which, under the recent agreement between the bond and stockholders' committees, is now about accomplished without the necessity of foreclosure, finds the company with a fixed charge of about $50,000. The preferred stock, under the reorganization, is but $340,000, and will, unquestionably, receive its 5 per cent dividend, which amounts to only $17,000.

The new Niagara Furnace of the Tonawanda Iron & Steel Co., which was started on the day after McKinley's election and went out last spring, will be put in again at an early day.

The Lackawanna shop at Scranton, Pa., will put several hundred men on ten hours time, after going on eight hours from the first of the year.

The strike in the No. 1 foundry of the City Foundry Co., Cleveland, ended Monday, Sept. 20, when 60 employes returned to work. They had struck because the company would not reinstate an employe who had quit work on the refusal of the company to pay him for a day's work, when he was laid off because there was nothing for him to do. No concession was made to the strikers.

In the past week complete machinery for the establishment of a wire-rope factory was loaded at Philadelphia, for shipment to Maripol, Russia. This place is fast becoming an important manufacturing center in the Black Sea, and within twelve months' time there have been shipped there from Philadelphia a complete locomotive plant and a pipe plant. These plants have about been erected and will soon be in running order,

Coleman, Shields & Co.'s mill at Niles, which some time ago shut down in all departments, will soon resume work. Improvements to the mill have been made.

The Wheeler Boiler Co., of Sharon, has an order for a 325 h. p. Wheeler water tube boiler for the Ohio Iron & Steel Co., Lowellville, O.

A new muck mill has been built by the Mahoning Valley Iron Co., Youngstown, O. The engine was built by Wm.

U. BAIRD MACHINERY CO.

123 AND 125 WATER STREET, **PITTSBURG, PA.** 124 AND 126 FIRST AVENUE.

MACHINE TOOLS AND SUPPLIES.

Some SECOND-HAND TOOLS in stock.

1—8-ft. Boring Mill.
1—No. "D" Horizontal Boring & Drilling Machine.
1—19-in. Putnam Slotter.
4—No. 11 Brown & Sharpe Milling Machines.
2—No. 1½ Stiles Presses.
1—No. 3 Stiles Press.
1—36-in. G. & E. Spur Gear Cutter.
2— Crank Planers.
3—No. 1 Brown & Sharpe Screw Machines.
2—No. 6 Brown & Sharpe Screw Machines.
1—36-in. Car-wheel Borer.
1—55-in. Pneumatic Riveter.
1—30-in. Pulley Lathe.
1—30-in Pulley Borer.
1—Pratt & Whitney Turret Lathe.
1—109-in. Engine Lathe.
1—15-in. Fox Turret Lathe.
1—20-in. Lodge-Davis Turret Lathe.
1—20-in. x 10-ft. Gleason Engine Lathe.
1—3-Spindle Drill Press.
2—30-in. Drill Presses.

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Steel Plants, Sheet and Tin Plants, Gas Furnaces and Producers Structural Iron and Steel.

Automatic Billet Heating Furnaces. **Plans and estimates furnished.**

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is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

THE LONG & ALLSTATTER CO.

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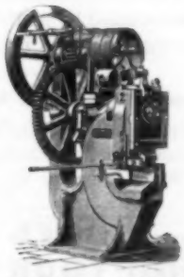
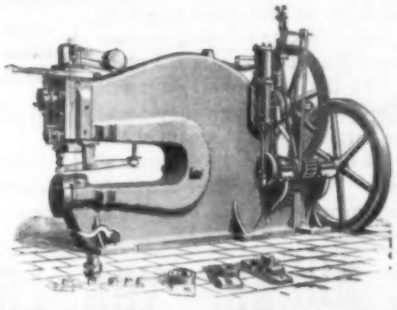
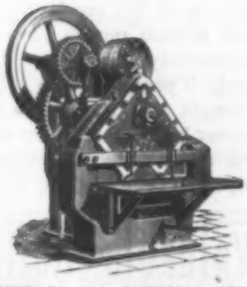




MANUFACTURERS AND EXPORTERS OF **POWER PUNCHING AND SHEARING MACHINERY** **ADAPTED TO ALL PURPOSES FOR BOTH HEAVY AND LIGHT WORK.**

Tod & Co. and the three-high mill by the Lloyd Booth Co., Youngstown.

It is reported that the Granite Iron Rolling Mills of the St. Louis Stamping Co., St. Louis, are to be sold to a syndicate, composed of Adolphus Busch and others.

The plant of the East Chicago Iron & Steel Co., at Hammond, Ind., which has been in the hands of a receiver for 18 months, will be sold to the highest bidder September 25.

Hannah Furnace of the Mahoning Valley Iron Co., at Youngstown, O., is about to blow in.

About 100 puddlers and other rolling mill workers have gone from the Pittsburg district to Birmingham, Ala., to work for the Alabama Iron & Steel Co. Iron workers are scarce in the South and it will be difficult for coke and blast furnace companies also to make any rapid increase in output because of the time that will be required to organize working forces at plants long idle.

The Milwaukee Harvester Works have resumed with 600 men. The output this winter will be increased 25 per cent over last year's. Thirty thousand harvesters and mowers will be manufactured, for shipment to all parts of the world. The company has made extensive improvements. A power house 65 x 120 feet in size and a four-story brick warehouse 68 x 125 feet in size are now being built, at a cost of $30,000.

The Harrington & King Perforating Co., 224 North Union st., Chicago, reports a growing consumption of perforated sheet metal, with an extension of the demand into new directions.

The American Brake Beam Co., Chicago, has certified to the Illinois Secretary of State to a reduction of capital stock from $2,500,000 to $500,000, and a reduction in the number of directors from nine to seven.

The Dean Brothers, pump manufacturers, Indianapolis, are running overtime. Among recent orders are the following: Three 12 x 30 x 24 air pumps and condensers for the Consolidated Steel & Wire Co., Pittsburg. The combined weight of these three pumps is 20 tons. They are also building four air pumps and condensers for the Indianapolis Natural Gas Co. works' new pumping station at Strantown, Ind. These pumps are to maintain a vacuum on gas compressors of 6,000 h. p. They also have contracts for the pumping machinery for two large lake steamers. They are building a number of hydraulic pumps for cotton oil mills. They report business good in their regular sizes.

The HP Nail Co., Cleveland, has just put in operation machinery for the manufacture of polished shafting, 1¼-inch and smaller.

The Glasgow Iron Co.'s plate mill at Pottstown, Pa., has been in continuous operation for a year past, a great portion of the time to its full capacity; the company's valley mill has been running, but not continuously, and its puddle mill, which has run but little during the past year, has recently been started up.

Dunbar Furnace of the Dunbar Furnace Co., at Dunbar, Pa., has been compelled to close down temporarily owing to failure of water supply.

It is reported that the Oil Well Supply Co., of Pittsburg, will start up its Elba Iron Works, in that city, soon, to manufacture pipes and tubes. This plant has been idle for some years, and the reason advanced for its probable starting up is the great improvement that has come in the pipe trade.

The Illinois Steel Co., through its general Southern agent, Wm. W. Bierce, recently closed the largest cement contract, ever known in the South, against cement which is shipped to New Orleans in ballast. The Illinois Steel Co.'s cement is manufactured from blast furnace slag.

The Cunningham-Jenkins Mfg. Co. will open the Irwin Foundry & Machine Works, at Irwin, Pa., and manufacture Keystone heaters.

Wm. McGregor & Co.'s boiler and machine shop at 55 and 57 South Clinton st., Chicago has been closed by the sheriff on fourconfessions of judgment aggregating $10,891.64.

The William S. Haines Co., Camden, N. J., has been incorporated to conduct the business of general iron founders and

the manufacture and sale of Heintz steam traps. The capital stock is $100,000; the amount paid in, $1,000. The incorporators are W. S. Haines, W. A. Levering and Erastus Wilman, of Philadelphia, and Alexander Duer, of Camden.

The general sales office of the American Tin Plate Co. will be removed from Indianapolis to Chicago, October 1. The company will occupy suite 1,115 Marquette Bldg., corner of Dearborn and Adams sts.

Work was resumed recently at the Lebanon Rolling Mills, Lebanon, Pa., after an idleness of seven months.

The South works of the Illinois Steel Co. have been making a heavy run on steel rails for the past month. In one day they rolled 2,023 tons. Never before have the various departments turned out such large outputs at such low cost.

THE Ingersoll-Sergeant Drill Co. has received an order from J. B. McDonald and Andrew Onderdonk, contractors of the Jerome Park Reservoir, N. Y., for a large air compressor plant, duplicating the plant which they now have ,except that the plant ordered is larger and has both steam and air cylinders compounded. This reservoir is being built for the purpose of increasing the storage capacity of the water supply of New York City. The area will be about 3,800 feet long and 2,800 feet wide, and will be excavated to a depth of 33 feet 6 inches. It will be necessary to excavate 3,165,000 cubic yards of solid rock. Almost every mechanical appliance is operated by compressed air. The original plant consisted of one Ingersoll-Sergeant duplex Corliss condensing air compressor, steam cylinders 24 and 44 x 48, two air cylinders 24¼ x 48, and capable of producing 540 h. p. at the pressure of 80 pounds at the receiver. Fourteen drills, 14 hoisting engines and several pumps have been operated by the original plant exclusively by compressed air, and the additional plant will make it possible to do all of the work by air power. It was thought at first, in view of the large supply of steam at the power house, that steam might be utilized and the expense of the additional compressor saved. When 2,000 feet of 4-inch pipe had been laid and the steam turned on, it was found that water and not steam was delivered at the end of the pipe line. This promptly settled the matter in favor of the second air compressor.

Important Change of Time.

Commencing Saturday, Sept. 18th, Mt. Vernon & Pan Handle train No. 28 for Columbus, Cincinnati, Indianapolis and St. Louis, will leave Cleveland at 8:00 P. M. daily except Saturday, and new train No. 306 will leave Saturdays only, at 11:20 P. M. These trains have Pullman sleepers for both Columbus and Cincinnati, which, for No. 306 can be occupied any time after nine o'clock P. M.

LOW RATES.

Via Pennsylvania Lines.

Special reductions in fare over the Pennsylvania Lines will be granted for numerous events to take place this summer in various parts of the United States, in addition to local excursions. Some of the points to which tickets will be sold and dates of sale are as follows:

To Nashville, Tenn., daily to October 15th, for Tennessee Centennial and International Exposition.

The reduced rates over the Pennsylvania Lines will not be restricted to members of the organization mentioned, but may be taken advantage of by the public generally. Excursion tickets may be obtained at ticket offices on the Pennsylvania System and will be sold over this route by connecting railways. Any Pennsylvania Line Ticket or Passenger Agent will furnish desired information concerning rates, time of trains, return limit, and other details to all applicants, or the same may be obtained by addressing C. L. Kimball, Assistant General Passenger Agent, Cleveland, O.

Steam Yachts and Marine Machinery.

Also Towing Launches built by Marine Iron Works, Clybourn and Southport avenues, Chicago. Free illustrated catalogue. Write them for it.—*Adv.*

Valuable Rolling Mill
FOR SALE.

Property Located at LEECHBURG, PENNA., 35 miles from Pittsburg, on the West Penn Division P. R. R.

These premises comprise 5 acres of valuable ground, upon which is erected a

New Iron Building, Modern Sheet Mill,
fully equipped, consisting of
3 SHEET MILLS or 4 TIN MILLS
—AND—
3 COLD ROLL MILLS.
SUITABLE BUILDINGS with PICKLING Appliances, Annealing Furnaces, Machine Shop, etc., etc.

2 NATURAL GAS WELLS
Perpetual rights to mine
COAL
on about 100 acres of land located near the mills.

For terms of sale, and further information, address
Geo. J Gorman, Trustee,
Lock Box 119. PITTSBURG, PA.

ARE YOU LOOKING
FOR A CHANGE IN LOCATION?

If you are not satisfied with your present site, or if you are not doing quite as well as you would like to, why not consider the advantages of a location on the Illinois Central R. R. or the Yazoo & Mississippi Valley R. R.? These roads run through South Dakota, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Kentucky, Tennessee Mississippi and Louisiana, and possess

FINE SITES FOR NEW MILLS,
BEST OF FREIGHT FACILITIES,
CLOSE PROXIMITY TO
COAL FIELDS AND DISTRIBUTING CENTERS
AND
INTELLIGENT HELP OF ALL KINDS,
MANY KINDS OF RAW MATERIAL.

For full information, write the undersigned for a copy of the pamphlet entitled

100 Cities and Towns WANTING INDUSTRIES

This will give you the population, city and county debt, death rate, assessed valuation of property, tax rate, annual shipments, raw materials, industries desired, etc.

To sound industries, which will bear investigation, substantial inducements will be given by many of the places on the lines of the Illinois Central R. R., which is the only road under one management running through from the North. Western States to the Gulf of Mexico. GEO. C. POWER, Industrial Commissioner I. C. R. R. Co., 506 Central Station, Chicago. I-2-'94

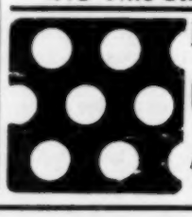
DOES YOUR ROOF LEAK?
If an old leaky tin, iron or steel roof, paint it with Allen's Anti-Rust Japan. One coat is enough; no skill required; costs little; lasts long.

The name describes it; proof against water, time, climate, and fumes of every description. Stops leaks, and prolongs the life of an old roof.

If you want evidence write us. To be returned at our expense if not satisfactory.

This Anti-Rust is also of highest value in protecting metal pipes, fans, etc., at mines, exposed to the corroding effects of *mine air* and *mine water*.

ALLEN ANTI-RUST MFG. CO.,
413 Vine St., Cincinnati, O.



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ORE, COAL, SAND
and all uses.
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GARWOOD, N. J.

NON-ARCING AUTOMATIC CIRCUIT BREAKERS
GUARANTEED TO OPERATE PERFECTLY OR NO PAY. MADE FOR ALTERNATING OR DIRECT CURRENT. ANY VOLTAGE. CATALOGUE FREE.
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The name of the Chicago, Milwaukee & St. Paul Railway has long been indentified with practical measures for the general upbuilding of its territory and the promotion of its commerce, hence manufacturers have an assurance that they will find themselves at home on the company's lines.

The Chicago, Milwaukee & St. Paul Railway Company owns and operates 6,154 miles (9,900 kilometers) of railway, exclusive of second track, connecting track or sidings. The eight States traversed by the lines of the company, Illinois, Wisconsin, Northern Michigan, Iowa, Missouri, Minnesota, South Dakota, and North Dakota, possess, in addition to the advantages of raw material and proximity to markets, that which is the prime factor in the industrial success of a territory—a people who form one live and thriving community of business men, in whose midst it is safe and profitable to settle. Many towns on the line are prepared to treat very favorably with manufacturers who would locate in their vicinity.

Mines of coal, iron, copper, lead and zinc, forests of soft and hard wood, quarries, clays of all kinds, tan-bark, flax and other raw materials exist in its territory in addition to the vast agricultural resources.

A number of new factories have been induced to locate—largely through the instrumentality of this company—at towns on its lines. The central position of the States traversed by the Chicago, Milwaukee & St. Paul Railway, makes it possible to command all the markets of the United States. The trend of manufacturing is Westward. Nothing should delay enterprising manufacturers from investigating. Confidential inquiries are treated as such. The information furnished a particular industry is reliable.

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Industrial Commissioner, C., M. & St. P. R'y
425 Old Colony Bldg., CHICAGO, ILL.

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STEAM TUBE WELDING WORKS.

Manufacturers of reworked boiler tubes
Good second-hand tubes bought.

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NOW $1.00.

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BEST LINE
Solid Trains
TO
Eastern Cities
STOP OVER
AT
WASHINGTON

THE CLONBROCK STEAM BOILER CO.,
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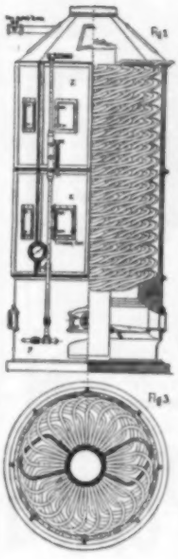

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WATER TUBE BOILERS

No Screw Joints. No Metallic Joints. No Ground Joints. No Packing Joints. No Cast Iron Pipes. Manifolds or Headers to cause trouble from Unequal Expansion or Contraction.

Quick and Steady Steamers,
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THE "COMPOUND" IS BUILT IN UNITS OF 50 TO 500 H. P.

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Specifications, Blue Prints, Etc., Furnished on Application.

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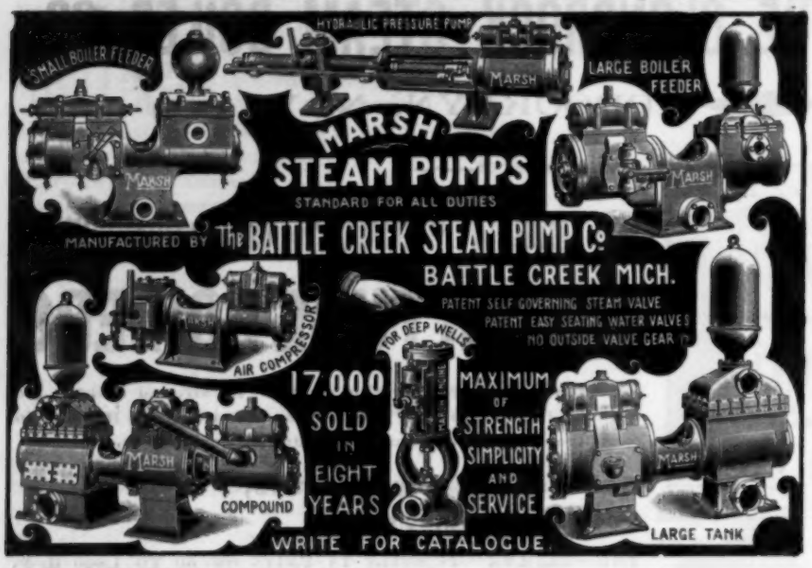

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The Iron Trade Review

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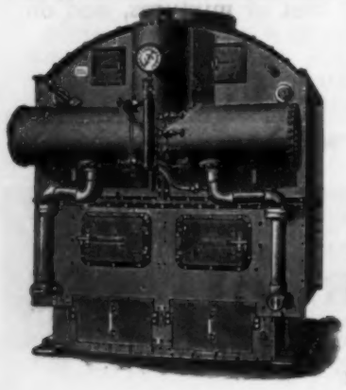

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This Boiler possesses more advantages than any other Boiler.

It has STOOD THE TEST of over seven years' constant daily use in passenger steamers, and is in use in many of the best steam yachts. It has proved its durability to be equalled by none. It has shown from 10 to 15 per cent saving in every day work over the best Marine Fire-Tube Boiler.

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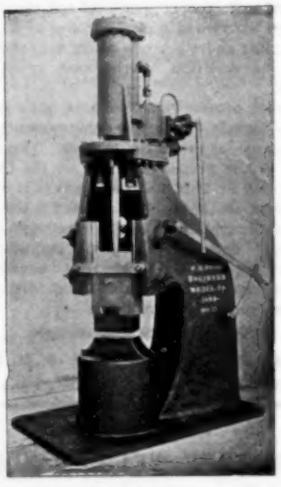

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*Daily. †Daily except Sunday.

‖Daily except Saturday. ‡Saturdays only.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	‖ 7:00 am	‖12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	† 3:15 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	* 5:00 pm	* 8:40 am
Philadelphia and New York	*11:10 pm	* 4:30 am
Baltimore and Washington	*11:10 pm	* 4:30 am
Alliance and Pittsburgh	*11:10 pm	* 4:30 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:50 am	* 5:30 pm
Akron and Columbus	* 8:50 am	* 5:30 pm
Akron and Columbus	† 1:40 pm	†12:10 pm
Col. Cin. Ind. & St. L.	‖ 8:00 pm	* 7:30 am
Col. Cin. Ind. & St. L.	‡ 11:20 pm	.....

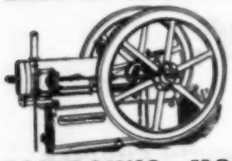
The Cleveland Terminal & Valley R. R. Co.

(B. & O. System.)

Depot foot of So. Water St.
City Office 241 Superior St.

	Arrive.	Depart.
Valley Jctn. & Way Stations	*6:20 P M	*7:10 A M
Akron, Canton & Valley Jct	*10:00 A M	*3:30 P M
Akron, Canton & Chicago	*8:10 A M	*6:35 P M
Akron, Canton & Wooster, Defiance, Garrett, Marietta, Wheeling, Washington, D. C., and Baltimore	†2:25 P M	†11:30 A

†Daily except Sunday. *Daily. Pullman's Palace Vestibule sleeping cars between Cleveland and Chicago.



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SQUARE FURNACE, SQUARE GRATE SURFACE.
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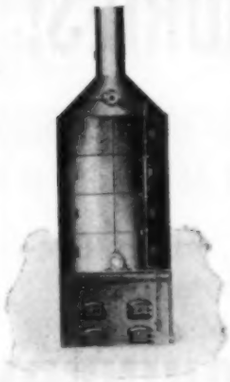

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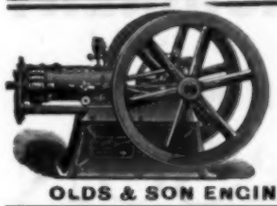
Cable Address, "Falls," N. Y **716 East 13th St., NEW YORK, U. S. A.**



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BECAUSE { No gears or levers, Simplest carburetor, "onderful Economy,

KNOW the REQUIREMENTS of a Gas Engine.

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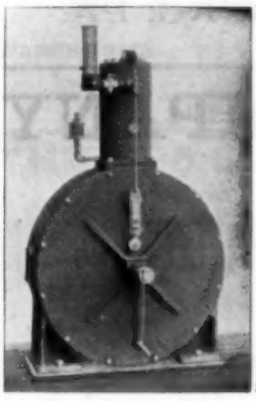

THE "BRIGHTON"

GAS AND GASOLINE ENGINES

ARE STRICTLY HIGH GRADE.

CLAIMS.

RELIABILITY,
DURABILITY,
SIMPLICITY,
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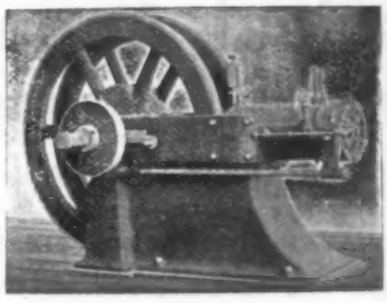

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STEAM ENGINES. **STEAM LOOPS.**
COMPLETE STEAM PLANTS. **COMPLETE ELECTRICAL PLANTS.**
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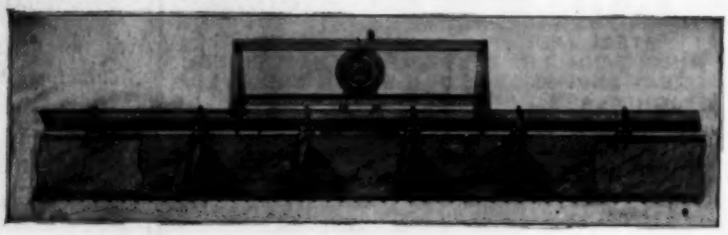

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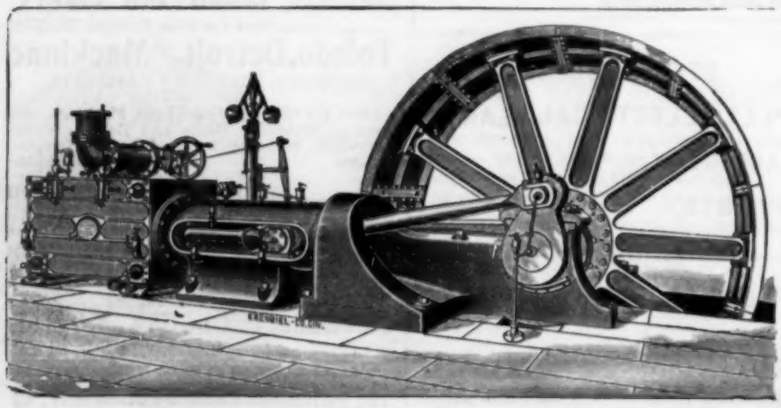

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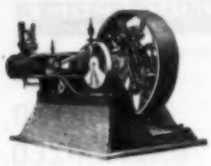

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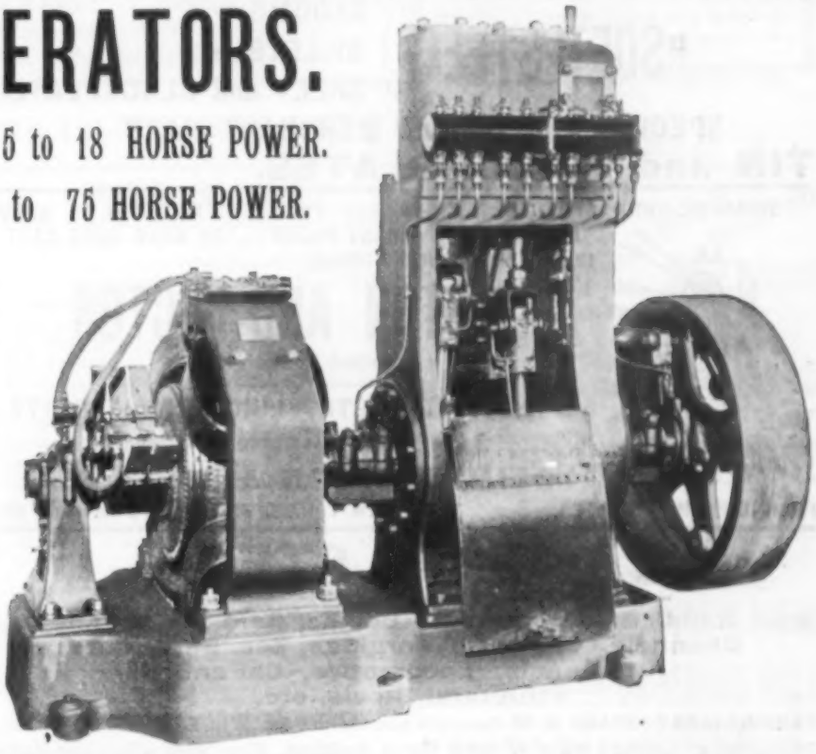

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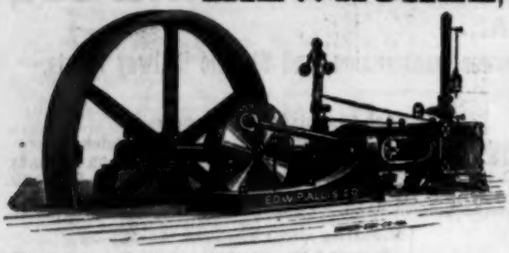

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Special low-phosphorus hard Ore, Bessemer	$3 40@ 3 46
No. 1 Specular, Bessemer	3 05@ 3 17
No. 1 Bessemer hematite	2 60@ 2 90
Hematites No. 1 non-Bessemer	2 00@ 2 25
No 1. Specular, non-Bessemer	2 40@ 2 60

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CLEVELAND (f. o. b. cars):	
Bessemer	$10 25@ 10 50
No. 1 Strong Foundry	10 25@ 10 65
No. 2 Strong Foundry	9 65@ 10 00
No. 1 Gray Forge, red short	9 40
No. 2 Gray Forge, neutral	9 65
No. 1 American Scotch	10 40@ 10 65
No. 2 American Scotch	9 90@ 10 15
Lake Superior Charcoal	12 25@ 12 50
PITTSBURG:	
No. 1 Foundry	$10 35@ 10 50
No. 2 Foundry	9 75@ 10 00
Gray Forge	9 50@ 9 75
White and Mottled	8 50
Warm Blast Charcoal	14 50@ 15 00
Cold Blast Charcoal	17 00
Bessemer	10 50@ 10 75
CHICAGO:	
Lake Superior Charcoal	$13 00@$13 25
Local Coke Foundry No. 1	11 00@ 11 50
Local Coke Foundry No. 2	10 50@ 11 00
Local Coke Foundry No. 3	10 25@ 10 50
Local Scotch Foundry No. 1	11 50@ 12 00
Local Scotch Foundry No. 2	11 00@ 11 50
Local Scotch Foundry No. 3	10 50@ 11 00
Southern Coke No. 1	11 00@ 11 25
Southern Coke No. 2	10 50@ 10 75
Southern Coke No. 3	10 25@ 10 50
Southern No. 1 Soft	11 00@ 11 25
Southern No. 2 Soft	10 50@ 10 75
Southern Silveries	10 60@ 10 75
Jackson Co. Silveries	12 50@ 14 50
Ohio Silveries No. 1	@
Ohio Strong Softeners	12 00@ 12 25
Alabama Car Wheel	16 50@ 16 00
Malleable Bessemer	10 75@ 11 00
Coke Bessemer	11 50@ 12 00
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$ 10 00
Southern Coke No. 2 and No. 1 Soft	9 50@ 10 00
Hanging Rock Coke, No 1	12 50@ 13 50
Hanging Rock Charcoal No. 1, Fdy	14 50@ 15 50
Tennessee Charcoal No 1	12 50@ 13 00
Jackson County Silvery No 1	12 50@ 13 00
Southern Coke, Gray Forge	8 25@ 8 50
" " Mottled	8 25@ 8 50
Standard Georgia Car Wheel	14 25@ 15 00
Tennessee " "	13 00@ 14 00
Lake Superior " "	14 75@ 15 25
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	10 50@ 10 75
No. 2 Foundry Strong Coke Iron Lake Superior Ore	10 00@ 10 25
Ohio Strong Softener No. 1	10 75@ 10 90
Jackson Co. Silvery No. 1	14 00
Lake Superior Charcoal	15 50
Southern Soft No. 1	11 60
Hanging Rock Charcoal	17 00
ST. LOUIS:	
Southern Coke No 1	$ 9 50@$ 9 75
Southern Coke No. 2	9 00@ 9 25
Southern Coke No. 3	8 50@ 8 75
Southern Gray Forge	8 00@ 8 25
Southern Charcoal No. 1	13 00
Missouri Bessemer	18 00
Ohio Softeners	13 50
Lake Superior Car Wheel	14 50
Southern Car Wheel	14 50

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	GROSS TONS
Old iron rails	$14 00
Old steel rails (6 ft. and over)	10 50
Old steel rails (6 ft. and under)	10 00
Old car wheels	11 00
	NET TONS
No. 1 R. R. wrought scrap	$11 50
Mill scrap	8 50
No. 1 Machine cast scrap	8 00
Iron axles	15 00
Axle turnings	8 00
Wrought turnings (free from cast)	6 50
Cast borings	5 25
Uncut wrought iron boilers	3 50
Steel boiler plates	8 00
Grate bars	5 25
Pipes and flues (clean)	7 50
Tank iron	7 00
Hoop and band iron	6 50
Sheet iron	5 00
Wrought drillings	6 00
Malleable iron	8 50

STRUCTURAL MATERIAL.

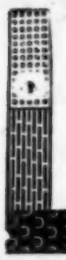
Beams and Channels (f. o. b. Cleveland)	1.10c
Angles	1.05c
Tees	1.15c
Universal Plates	1.10@1.15c
Sheared Plates	1.15c

MERCHANT IRON AND STEEL.

[Less than car-lots, Cleveland.]

Rounds and Squares.—Bar Iron.

1 to 1½	1.00 Base.
2 to 2½	.20 extra.
3 to 3½	.50 "
3½ to 4	.80 "
4½ to 4¾	1.00 "
4½ to 5	1.30 "
5½ to 6	1.80 "
6¼ to 6¾	2.30 "



PERFORATED METALS

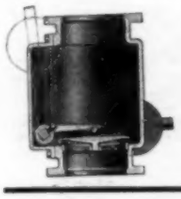
OF ALL KINDS FOR

MILLING, MINING AND AGRICULTURAL MACHINERY.

Perforated Iron, Steel, Copper, Brass, Tin, Zinc, Lead, Etc., to Order.
Large and Varied Assortment of Sizes. Correspondence Solicited.

THE ROBERT AITCHISON PERFORATED METAL CO.,

Office, Room 510, 265 to 269 Dearborn St., CHICAGO, ILL. Works, So. Chicago.



Excelsior Straight-Way Back Pressure Valve.

This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

JENKINS BROTHERS, NEW YORK, PHILADELPHIA, BOSTON, CHICAGO.

Subscribe for the Iron Trade Review, $3 per year.

Don't Waste Money in Your Pattern Shop.
THE GOBEILLE PATTERN CO., Cleveland.

THE JACKSON SAND MINING CO.,

JACKSON, O.

Producers of SILICA, FIRE and CORE SAND. Also MOLDING SAND for STEEL CASTINGS. Write for Prices.

"Metallurgy of Cast Iron,"

By THOS. D. WEST; 107 engravings, 583 pages. Just issued. A valuable work to Founder, Molder, Draughtsman, Designer, Technical School Specialist. Chemistry of Iron; cheaping of mixtures; the effect of the metalloids in changing the grade of iron; latest improvements in cupola construction and practice—all are fully covered. Price $3. Sent postpaid on receipt of price, by *The Iron Trade Review Co.*, Cleveland, O; 1142 Monadnock Block, Chicago, Ill.

James M. Swank, author of "Iron in All Ages," and editor of the *Bulletin* of The American Iron & Steel Association, in reviewing "Metallurgy of Cast Iron," says it is "One of the most valuable publications relating to the manufacture of iron castings, that has ever, to our knowledge, been issued in this or any other country."

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.

CLEVELAND OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE

Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

6¾ to 7¾	2.50 extra.
⅞ to 3⅛	.10 "
3⅛ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 11-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅛ to 1	1.05 Base.
4¼ to 6 x ⅛ to 1	.10 extra.
6¼ to 8 x ⅛ to 1	.60 "
8¼ to 10 x ⅛ to 1	.80 "
1⅛ to 4 x 1 1-16 to 1¼	.30 "
4¼ to 6 x 1 1-16 to 1⅛	.40 "
6¼ to 8 x 1 1-16 to 1⅛	.60 "
8¼ to 10 x 1 1-16 to 1⅛	.90 "
2 to 4 x 1⅛ to 2	.50 "
4¼ to 6 x 1⅛ to 2	.60 "
6¼ to 8 x 1⅛ to 2	.80 "
8¼ to 10 x 1⅛ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1⅛ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
¾ to 15-16 x ⅜ to ⅝	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
⅞ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅛ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
⅞ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1⅛ to 4 x No. 9 to 3-16	.40 "
1⅛ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40 "
⅜ x No. 9 to 3-16	1.50 "
⅜ x Nos. 10, 11 and 12	1.60 "

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1⅛	.40 extra.
⅜ to 13-16	.50 "
⅜ to 11-16	.60 "
½ to 9-16	.80 "
⅜ to 7-16	1.10 "
¼ to 9-16 x 3-16	1.00 "
⅜ to 11-16 x ⅛	1.20 "

Half Oval and Half Round.

2¼ to 2	.60 extra.
⅜ to 2	.50 "
⅜ to 13-16	.70 "
⅜ to 11-16	.90 "
⅜ to 9-16	1.20 "
⅜ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes 1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width In Inches.	English Standard Gauge.	
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.90 Base.
		Extras.
1¼ to 6,	" 10, 11, 12 or 1/4"	.05 per 100 lbs.
1 to 1¾,	" 7, 8, 9 or 3-16"	.10 "
1 to 1⅜,	" 10, 11, 12 or 1/4"	.15 "
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20 "
13-16 and ⅞,	" 10, 11, 12 or 1/4"	.25 "
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30 "
11-16 and ¾,	" 10, 11, 12 or 1/4"	.35 "
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40 "
9-16 and ⅝,	" 10, 11, 12 or 1/4"	.45 "
½,	Nos. 7, 8, 9 or 3-16"	.55 "
½,	" 10, 11, 12 or 1/4"	.60 "
7-16	" 7, 8, 9 or 3-16"	.75 "
7-16	" 10, 11, 12 or 1/4"	.85 "
⅜,	" 7, 8, 9 or 3-16"	.95 "
⅜,	" 10, 11, 12 or 1/4"	1.05 "

Iron and Steel Hoops.

Width in Inches.	English Standard Gauge.	
1 7-16 to 3	Nos. 13, 14, 15 and 16	1.60 Base
		Extras
1 7-16 to 2,	" 17, 18, and 19	.05 per 100 lbs
1 7-16 to 2,	" 20	.10 "
1 7-16 to 2,	" 21	.15 "
1 7-16 to 1¾,	" 22	.25 "
1 ⅛ to 1⅜,	" 13, 14 and 15	.05
1¼ to 1¾	" 16, 17 and 18	.10

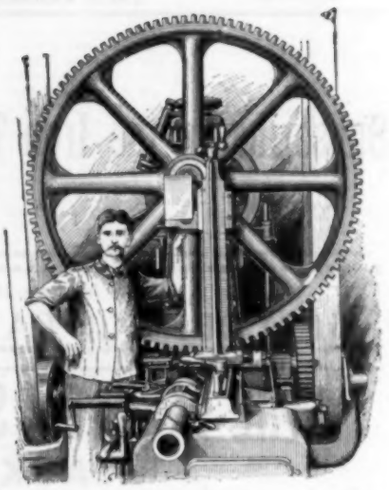
F. A. ESTEP, Pres. & Treas. J. R. McGINLEY, Vice Pres't. THOS. FAWCUS, Supt.

Watch the Little Indicator When the Wheel Stops

and you will see that it points accurately to where the next tooth is to be cut. It is this accuracy that makes

CUT GEARS

Economical of power and long lived.



R. D. NUTTALL CO.,

99 Boquet St.,

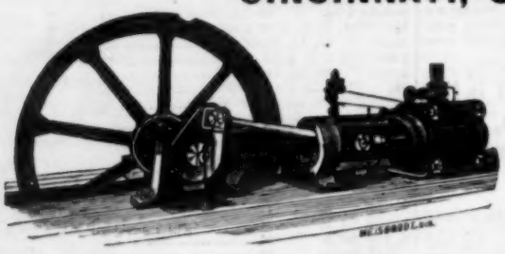
Write us. ALLECHENY, PA.

Persistence in Advertising

Is one of the requisites of satisfactory results. In the expansion of business which is confidently expected in the United States in the very near future, advertisers who have made themselves regularly prominent in the past two years will be first to reap the rewards of persistent publicity.

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



Engines,

ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

Belt Elevators, Saw Mills.

1⅛ to 1⅜,	"	19 and 20	.15 per 100 lbs.
1⅛ to 1⅜,	"	21	.20 "
1⅛ to 1⅜,	"	22	.30 "
15-16 and 1,	"	13, 14 and 15	.10 "
15-16 and 1,	"	16, 17 and 18	.15 "
15-16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞,	Nos.	13, 14 and 15	.20 "
⅞,	"	16, 17 and 18	.25 "
⅞,	"	19 and 20	.30 "
⅞,	"	21	.35 "
⅞,	"	22	.45 "
¾ and 13-16	Nos.	13, 14 and 15	.30 "
¾ and 13-16	"	16, 17 and 18	.35 "
¾ and 13-16	"	19 and 20	.40 "
¾ and 13-16	"	21	.45 "
¾ and 13-16	"	22	.50 "
¾ and 13-16	"	23	.60 "
11-16,	Nos.	13, 14 and 15	.35 "
11-16,	"	16, 17 and 18	.40 "
11-16,	"	19 and 20	.50 "
11-16,	"	21	.60 "
11-16,	"	22	.70 "
11-16,	"	23	.80 "
⅝,	Nos.	13, 14 and 15	.40 "
⅝,	"	16, 17 and 18	.45 "
⅝,	"	19 and 20	.55 "
⅝,	"	21	.65 "
⅝,	"	22	.75 "
⅝,	"	23	.85 "
9-16,	"	13, 14 and 15	.45 "
9-16,	"	16, 17 and 18	.50 "
9-16,	"	19 and 20	.60 "
9-16,	"	21	.70 "
9-16,	"	22	.80 "
9-16,	"	23	.90 "
½,	"	13, 14 and 15	.55 "
½,	"	16, 17 and 18	.60 "
½,	"	19 and 20	.70 "
½,	"	21	.80 "
½,	"	22	.90 "
½,	"	23	1.00 "
7-16,	"	13, 14 and 15	.80 "
7-16,	"	16, 17 and 18	.90 "
7-16,	"	19 and 20	1.00 "
⅜,	"	13, 14 and 15	1.00 "
⅜,	"	16, 17 and 18	1.10 "
⅜,	"	19 and 20	1.20 "

Sheet Iron.

No. 10	1 50
No. 12	1 70
No. 14	1 60
No. 15-17	1 75
No. 18	1 85
No. 20	2 00
No. 22-24	2
No. 25-26	2 20
No. 27	2 30

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

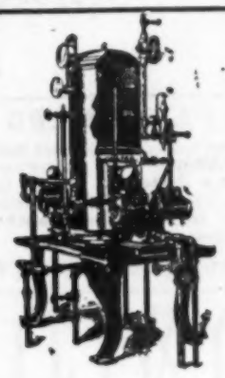
The Link-Belt Machinery Co.

ENGINEERS. FOUNDERS. MACHINISTS.

CHICAGO, U. S. A.

Modern Methods as applied to the handling of Iron Ore, Coal, Raw and Manufactured Products.

Manila Rope, Power Transmissions, Shafting, Pulleys, Shaft Bearings, Gearing Friction Clutches, etc.



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BURNING FUEL OIL.

Heats and cleans the oil and delivers it to the fires under high and uniform pressure.

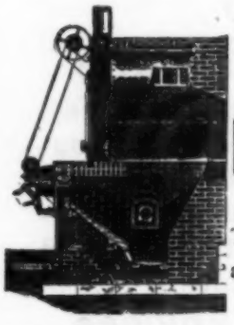
Entirely automatic, most scientific, sensible and economical method of burning oil in existence. If you are operating a Steel Works, Brass or Copper Rolling Mill, Malleable Iron Works, Bolt and Nut Works, Bicycle Works, or do Annealing, Forging, Brazing, Tempering, Japanning, Enameling, Case Hardening, you can use this machine to your advantage.

WE BUILD FURNACES OF ALL KINDS. SATISFACTION GUARANTEED.

W. S. ROCKWELL & CO.,

26 CORTLANDT STREET, NEW YORK.

H. H. CAMPBELL.



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648 Broadway, CLEVELAND, O.

SOLE MANUFACTURERS OF THE

Brightman Mechanical Stoker

FOR STEAM BOILERS.

THE MOST ECONOMICAL IN FUEL

and the Best Device in the World for Preventing Smoke.

Send for Catalogue "A."

STUART FIRE BRICK CO.

MANUFACTURERS OF

Silica Brick

For Open-Hearth, Basic and Acid Steel Furnaces, Glass and Copper Tank Furnaces. Extra Shapes MADE TO ORDER.

Office, Room 21, Conestoga Bldg., Cor. Wood and Water Sts., PITTSBURG, PA.

The Chicago & North-Western Railway

REACHING with its 7,900 miles of road the famous Water Powers, Coal Fields, Iron Ore Ranges, Hard and and Soft Lumber Districts located in Illinois, Wisconsin, Michigan, Iowa, Minnesota, South Dakota, North Dakota, Nebraska and Wyoming, and by traffic arrangements with other railways, 7,350 stations located on 41,000 miles of railroad (one-ninth of the entire railroad mileage of the world, and one-fourth of the railroad mileage of the United States), has on its line more industries than any other western railroad.

Manufacturers contemplating moving or establishing branch factories in the West are requested to inquire what we can offer them before locating elsewhere.

M. HUCHITT,
General Freight Agent,
CHICAGO.

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 35
Shell	1 45
Flange	1 55
Marine Flange	1 60
Fire Box	2 05

Above includes plates 90 inches wide.

90 to 96 in. wide	¼c. lb. extra
96 to 100 in. wide	1c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special.

Flats. cts. lbs.

2 to 9-16 in. wide by 2 to ⅝ thick .08

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 40
Open-hearth Tire	"	1 45
Open-hearth Spring	"	1 80
Sleigh Shoe	"	1 45
Toe Calk	"	1 90
Cutter Shoes, tapered and bent	"	1 60

American Cast Tool Steel.

ROUND, SQUARE, AND OCTAGON. cts lbs.

1 to 2 in. inclusive	.08
9-16 to ⅞ in. "	.08
7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅛ to 4 in	.09½
⅝ to 11-16 and 4⅛	.10
⅛ to 6 in	.10½
¼ to 9-32 and 6⅛ to 7 in	.11
1 in	.13

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 10
Bridge ½, ⅝, 11-16 and ¾ inch diam	2 55

Wrought Pipe and Boiler Tubes.

Lap weld black, base, four 10s	.62
Butt " " four 10s	.62½
Lap " galv. " four 10s	.52½
Butt " " " four 10s	.50
Boiler tubes 2¼" and smaller	.70
Boiler tubes 2½" and larger	.75
Casting screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

[From Store, Cleveland.]

Anti-Friction Metals.

Magnolia Anti Friction Metal, 25 cts. per lb., f. o. b New York or Chicago.

No Name Metal, 18 cts. per lb., f. o. b. New York or Chicago.

Mystic Metal, 8 cts. per lb., f. o. b. New York or Chicago.

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths' Hill's	dis 40
Blacksmiths' Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 10 & 10
" " " extra	dis 60&10
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 50
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 80
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 33⅓
Horton's Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 45
Sweetland "	dis 40
Almond Drill	dis 40
Morse "	dis 20
Skinner's Combination Lathe	dis 40&15
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 30

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 10 to 13
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills

Morse Taper & Straight Shank to 1¼"	dis 50 & 10 to 60
Morse Taper and Straight Shank Larger than 1¼"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 60@60&5
Cleveland " "	dis 60@60&5

Emery.

	No. 4 to No. 54 gr.	150 gr.	Flour, C. F. F.
Kegs, ℔ lb	4½c	5 c	2½c
½ kegs ℔ lb	4½c	5½c	2½c
¼ kegs ℔ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	½c

Emery Cloth and Paper.

Barder, Adamson & Co. ..... dis 50@50&5
H. H. Barton ..... dis 50@50&5

Emery Wheels.

Detroit ..... dis 60@70
Norton's ..... dis 60@70
Grant ..... dis 60@70
Sterling ..... dis 60@70
Celluloid ..... dis 10&33⅓
Northampton ..... dis 50
Crystal ..... dis 65@70
Vitrified ..... dis 60@70
Vulcanite ..... dis 60&10
Hamden ..... dis 60&10@70
Cyclone ..... dis 60@60&10

Files.

Arcade ..... dis 60&10@60&10&10
Nicholson ..... dis 60&10@60&10&10
" X. F ..... dis 25
Kearney & Foot ..... dis 60&10@60&10&10
Black Diamond ..... dis 60&10@60&10&10
McClellan ..... dis 60&10@60&10&10
Disston's ..... dis 65@70
Western ..... dis 70
Stub's ..... dis 25
Grobet's ..... dis 30
Reynolds Bros.' Hand Cut ..... dis 50
Industry File Works Hand Cut ..... dis 50

Hammers.

P. S. W ..... dis 40
Atha new list, Jan. 15, 1887 ..... dis 50
Heavy hammers and sledges under 5 lbs 10c
" " " " over 5 lbs 8c

Jack Screws.

Illinois Bolt Co. list ..... dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	13½	11½	8½	6	5⅜	5⅛	
Washers	9	8	7	5	4½	4½	4¼

In lots less than 100 lbs, ℔ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

Standard Penny Nails, ℔ keg, base.
Car lots $1.30
Less than car lots $1.40

Oilers.

Zinc and Tin ..... dis 60
Brass and Copper ..... dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ℔ doz ..... dis 10@10&10

Picks.

Railroads, 5 to 6 lbs ..... $12 dis 60
" 6 to 7 lbs ..... $13 dis 60

Rivets.

Iron, Thousand, list November 1, 1894 ..... dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894 ..... dis 60@65
Copper ..... dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in ..... dis 5%
Carpenters' " " " ..... dis 5%
Morse " " " ..... dis 5%
Pratt & Whitney " " " new list ..... dis 10
Machine Screw Taps ..... dis 55
Pipe Taps to 2½ in ..... dis 70
Stay Bolt Taps ..... dis 25
Stove Bolt Taps ..... dis 55
Pulley Taps ..... dis 40

Vises.

Solid Box ..... dis 60
Parker's ..... dis 20@25
Prentiss ..... dis 20
Stephen's ..... dis 25@30
Barrett's ..... dis 30
Miller's Falls ..... dis 40
Merrill's ..... dis 15@20
Howard ..... dis 35

Wire.

New List, Apr. 9, 1894

Brass ..... dis 35c
Copper ..... dis 35c
Bright and annealed, Nos. 0@18 ..... dis 70&10@75
" " Nos. 19@26 ..... dis 75@75&5
" " Nos. 27@36 ..... dis 75&10&5
Coppered Nos. 0 to 18, market list ..... dis 70@70&5
Galvanized Nos. 0 to 18 " " ..... dis65&5
Tinned market Nos. 0 to 18 ..... dis 67½
Cast steel ..... dis 50
Tinned Broom Wire ..... dis 70&5@70&10
Annealed Fence, Nos. 8 and 9 ..... dis 75
Annealed Grape, Nos. 10 to 14 ..... dis 75
Stub's Steel Wire regular ..... 95c ℔ lb dis 30

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Testing Laboratory.

WM. B. PHILLIPS. DAVID HANCOCK.

All Kinds of Chemical Work. Reports on Mining Property and Technical Processes.

Office and Laboratory at Birmingham Rolling Mill

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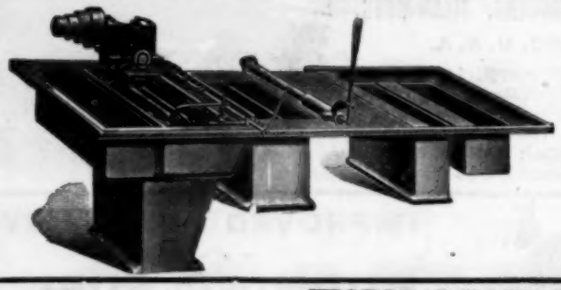

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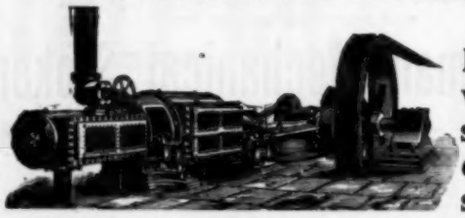

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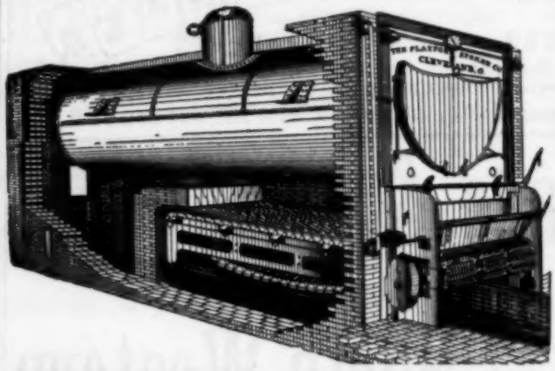

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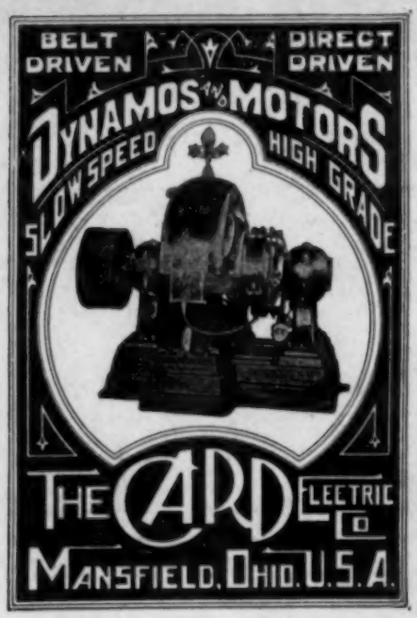

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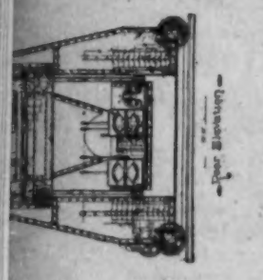

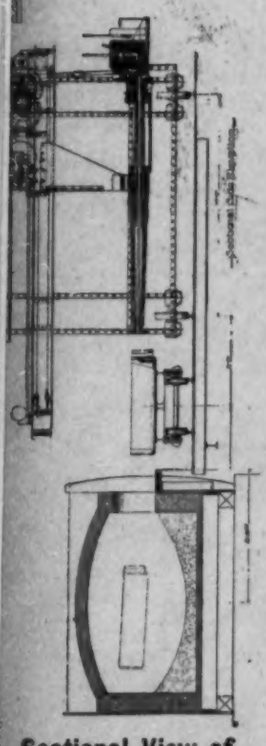

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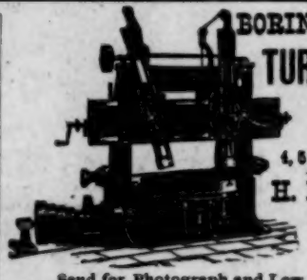

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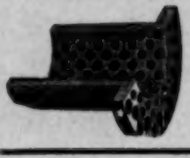

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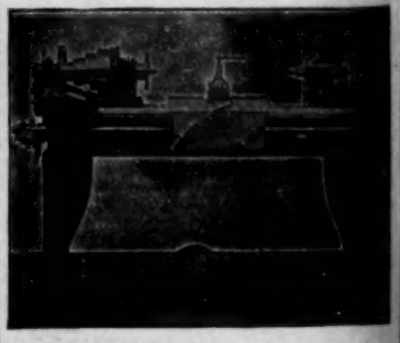

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